PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

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Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, " : " e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

7.923 1103
Mathieu functions and their classification. McLachlan, N. W. *J. Math. Phys.*, **25**, 209–40 (*Oct.*, 1946).

7.942.9 : 531.225 : 532.51 : 537.21 1104
Numerical solution of axisymmetrical problems, with plications to electrostatics and torsion. Shortley, G., eller, R., Darby, P., and Gamble, E. H. *J. Appl. ys.*, **18**, 116–29 (*Jan.*, 1947).—Numerical methods are ven for solution of problems involving the equation $\frac{\partial^2\psi}{\partial z^2}+\frac{\partial^2\psi}{\partial\rho^2}+\frac{K}{\rho}\frac{\partial\psi}{\partial\rho}=0$, where ρ is the radial co-ordinate d z the co-ordinate parallel to the axis. For Laplace's uation, $K=1$. For the Stokes' stream function, $=-1$, but for numerical work a new function, the *w-disturbance function*, having $K=3$, is more tractable. new function with $K=5$, the *stress-concentration nction*, is much easier to compute than the usual stress function ($K=-3$) for the case of the torsion of a circular shaft of varying dia. The equipotentials for an electron lens and the stresses and strains in a particular grooved circular shaft under torsion are computed. A.

518.421 = 4 1105
The hyperbolic scale, generalization of the linear and logarithmic scales. Legros, R. *Ann. Phys., Paris* (*Sér.* 12) **1**, 335–56 (*May–June*, 1946) *In French.*—The scale is defined and its advantages are discussed. It is linear near the zero point and symmetrical about this; it is logarithmic for large values of the variable. Several examples are given. One of these relates to the curve showing the intensity of magnetization as a function of the field strength in a ferromagnetic material. L. S. G.

519.4 1106
On the simple group of order 25920. Todd, J. A. *Proc. Roy. Soc. A*, **189**, 326–58 (*May* 1, 1947).

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.038 : 525.24 1107
Induction of a flow of fast charged particles by rotating agnetized cosmic bodies. Terletzky, J. *J. Phys., SSR*, **10** (*No.* 4) 377–82 (1946).—The motion of arged particles in the electromagnetic field of a rotating agnetized cosmic body with non-coincident magnetic id geographic poles is computed. The energy up to hich the particles can be accelerated in such a field is lculated. A.

23.161 1108
Distribution of interstellar gas. Merrill, P. W. *ubl. Astr. Soc. Pacif.*, **58**, 354–8 (*Dec.*, 1946).—A note the changes necessary in the original theory of stribution, due to observations made since 1900. E. G. M.

23.162 : 523.874 1109
The ratio of interstellar absorption to reddening. reenstein, J. L. *Astrophys. J.*, **104**, 403–13 (*Nov.*, 946).—The material derived from photo-electric 6-colour notometry by Stebbins and Whitford is used. The first pproximation of a variation $\propto 1/\lambda$ gives way to a new due of $1/\lambda^{0.56}$. The relation between various colour dex scales is discussed, and a comparison is made tween Greenwich gradients and short baseline scales. inally an interpretation of the new value is examined, ith suggestions for future work to decide whether the sorbing particles are mainly metals or dielectrics. ee Abstr. 2244 (1946)]. E. G. M.

23.38 1110
The radiant-energy gradient of the earth's penumbral adow. Morrison, C. A. *Publ. Astr. Soc. Pacif.*, **58**, 01–6 (*Oct.*, 1946).—Describes methods and results tained at the lunar eclipse, Dec. 1945. The moon was otographed at 10 min intervals as it passed from the nbra to complete emergence. E. G. M.

23.53 : 537.564 : 551.510.535 *see Abstr.* 1371

23.746 1111
Magnetic field of sun spots. I. Gurevich, L., and ebedinsky, A. *J. Phys., USSR.*, **10** (*No.* 4) 327–32 946).—A hypothesis is put forward from which it sues that in the outer layers of the sun spot there exists magnetic field of several thousand gauss, and that the agnetic fields in the components of bipolar groups of in spots are oppositely directed. A.

23.77 1112
On the chemical constitution of the solar atmosphere. Strömgren, B. *Festschr. Elis Strömgren* (*Copenhagen*) 218–57 (1940).—The non-appearance of metal absorption edges in the solar spectrum is explained by assuming opacity in the sun's outer layers to be due to H^- absorption, hydrogen being supposed enormously abundant compared with metals. The actual ratio R of numbers of hydrogen and metal atoms is determined by comparing the intensities of weak and strong metal lines, the first unaffected by Lorentz broadening, and the second broadened by collisions with H atoms. By comparing the Ca lines at 6 573 and 3 934 Å, and the Na lines at 3 302 and 5 890 Å, R is estimated as $\sim 8\,000$. This agrees with Unsöld's estimated number of Balmer-absorbing H atoms above the photosphere, assuming thermodynamic equilibrium. T. G. C.

523.851.2 1113
The diameters of globular clusters. Mowbray, A. G. *Astrophys. J.*, **105**, 47–57 (*Jan.*, 1947).—This paper gives estimates of 69 clusters from photographs taken in blue and red light, and comparisons with the results found by other workers. A low correlation value between absolute brightness and linear diameter was found. The reasons for this failure are discussed. E. G. M.

523.851.2 : 523.873 *see Abstr.* 1116

523.872 1114
The spectrum of T Coronae Borealis at the 1946 maximum. Herbig, G. H., and Neubauer, F. J. *Publ. Astr. Soc. Pacif.*, **58**, 196–208 (*June*, 1946).

523.873 1115
Infra-red spectra of early-type stars. Hiltner, W. A. *Astrophys. J.*, **105**, 212–14 (*Jan.*, 1947).—A descriptive discussion, with emphasis on shell and emission-line stars. A.

523.873 : 523.851.2 1116
Spectral types of stars in the globular clusters Messier 3 and Messier 13. Popper, D. M. *Astrophys. J.*, **105**, 204–11 (*Jan.*, 1947).

523.874 : 523.162 *see Abstr.* 1109

523.877 1117
Tables of model stellar atmospheres. Strömgren, B. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **21** (*No.* 3) 85 *pp.* (1944).—Continues earlier work [Abstr. 1112 (1947)]. The atmosphere is supposed to consist of hydrogen and metals, in a ratio between 1 000 : 1 and 16 000 : 1;

the tables can also be used, with modification, when He, O and C are present in strength. The effective temperatures considered range from 5 740° to 8 500°, and surface gravities from 10^3 to $10^{4\cdot5}$ dynes/cm². Free electrons are supposed due to metals at low temperatures, H at high; opacity is due to H^- ions at low temperatures, H atoms at high. Preliminary tables give the ionization and opacity at various pressures; final tables give total pressure, electron pressure, opacity and temperature at optical depths ranging from 0·01 to 10, assuming radiati equilibrium throughout. Subsidiary tables give t variation of pressure and electron-pressure with ter perature in the hydrogen convection zone on the altern tive assumption that the temperature-gradient is radiati there. T. G.

525.75 : 535.338 = 4 *see Abstr.* 1176

526.918.52 : 778.35 : 551.468 *see Abstr.* 1370

PHYSICS 53

53.081 : 535.241 *see Abstr.* 1170

53.081.3 : 539.152.1 *see Abstr.* 1265

FUNDAMENTALS 530.1

530.12 1118

On a certain criterion of relativistic invariance. MARKOV, M. *J. Phys., USSR*, **10** (*No.* 4) 333–40 (1946).

530.12 1119

Kinematic relativity. WILSON, W. *Phil. Mag.* (*Sér.* 7) **37**, 421–6 (*June*, 1946).—A continuation of previous work [Abstr. 1954 (1944)], and a reply to various criticisms. A fundamental formula due to Milne is derived by a new short method. L. S. G.

530.12 : 530.145 1120

Quantized space-time. SNYDER, H. S. *Phys. Rev.*, **71**, 38–41 (*Jan.* 1, 1947).—It is usually assumed that space-time is a continuum. This assumption is not required by Lorentz invariance. An example of a Lorentz-invariant discrete space-time is given. A.

530.12 : 531.15 1121

Notes on rotation and rigid bodies in relativity theory. ROSEN, N. *Phys. Rev.*, **71**, 54–8 (*Jan.* 1, 1947).

530.12 : 531.51 : 537.1 1122

The general affine field laws. SCHRÖDINGER, E. *Proc. R. Irish Acad.*, **51 A**, 41–50 (*Nov.*, 1946).—This completes the theory begun earlier [Abstr. 2514 (1943)]. The variation of a Lagrangian with respect to the coefficients of a non-symmetric affine space-time connection yields 3 sets of field equations corresponding to gravitation, electromagnetic and meson fields. The hypothesis of weak asymmetry [Abstr. 2543 (1944)] is now unnecessary. The electromagnetic and meson fields are separated by a suitable transformation, so that the former is exactly described by 2 skew 6-vectors satisfying linear equations of the usual type with interactions. The meson equations reduce to the Proca equations for weak fields, with an extra term due to a small direct interaction with the gravitational field. For strong meson fields the theory gives more complicated non-linear equations, which are not investigated. This may be why the linear classical theory fails to give a clear account of nuclear problems, where meson fields are large. G. J. K.

530.14 1123

Infinite irreducible representations of the Lorentz group. HARISH-CHANDRA. *Proc. Roy. Soc. A*, **189**, 372–401 (*May* 1, 1947).—It is shown that corresponding to every pair of complex numbers κ, κ^* for which $2(\kappa - \kappa^*)$ is real and integral, there exists, in general, one irreducible representation D_{κ,κ^*} of the Lorentz group. However, if 4κ, $4\kappa^*$ are both real and integral, there are two representations D^+_{κ,κ^*} and D^-_{κ,κ^*} associated to the pair (κ, κ^*). All these representations are infinite except D_{κ,κ^*} which is finite if 2κ, $2\kappa^*$ are both integral. For suitable values of (κ, κ^*), D_{κ,κ^*} or D^+_{κ,κ^*} is unitary. U and B matrices similar to those given by Dirac [Abstr. 3489 (1936)] and Fierz [Abstr. 983 (1939)] are intro duced for these infinite representations. The extensio of Dirac's expansor formalism to cover half-integral spi is given. These new quantities, which are called expinor bear the same relation to spinors as Dirac's expansors t tensors. It is shown that they can be used to describe th spin properties of a particle in accordance with th principles of quantum mechanics.

530.14 112

On the expansibility of solutions in powers of th interaction constants. BHABHA, H. J. *Phys. Rev.*, 7 759–60 (*Nov.* 1 *and* 15, 1946).—Physical solutions of th classical equations of motion of point particles can b expanded in ascending powers, but non-physical solution cannot, e.g. the runaway solutions of the Dirac equation of an electron. If this is true in quantized theories as postulate, then the usual perturbation methods corre sponding to such an expansion automatically exclud non-physical solutions. G. J. K.

530.145 112

The invariant form of quantum equations and th Schroedinger–Heisenberg parallelism. CORSON, E. M *Phys. Rev.*, **71**, 200–8 (*Feb.* 1, 1947).—The paper consider the invariant form of the equations of motion in relatio to the Schroedinger–Heisenberg pictures of quantu mechanics in so far as the latter refer to the "pictured" intrinsic motion of states (vectors) and observable (Hermitian operators). The discussion is divided into 5 sections: Operator and Vector Transforms, Contact Transformations, Heisenberg–Schroedinger Operators, Equations of Motion and Invariant Properties, and the Density Operator and Operator Spur. Where possible, quasi-geometrical diagrams are given to illustrate the relation and transition between the several "pictures of the motion." A.

530.145 1126

A note on the Hamiltonian theory of quantization. II. CHANG, T. S. *Proc. Camb. Phil. Soc.*, **43**, 196–204 (*April*, 1947).—An extension of previous work [Abstr. 1243 (1945)]. The question of Lagrangians in which some of the conjugate momenta are not independent or are missing is discussed. If the Lagrangian is gauge-invariant, some of the p's must be missing, and the corresponding Eulerian equations may be replaced by equations containing no q and then by initial conditions. The commutation relations between gauge-invariant quantities are Lorentz-invariant. For Lagrangians which have missing momenta but are not gauge-invariant, the passage to quantum theory gives rise to non-Lorentz-invariant commutation relations. L. S. G.

530.145 = 3 1127

Quantum theory of fields. BOPP, F. *Z. Naturforsch.*, **1**, 196–204 (*April*, 1946) *In German.*—A field theory involving action at a distance with a parameter is quantized and a Dirac-type wave equation obtained for the particles. The extra degree of freedom corresponds to spin with integral values. G. J. K.

30.145 : 530.12 *see Abstr.* 1120

30.145 : 535.14 1128

Angular momentum of photons. BALSEIRO, J. A. *Phys. Rev.*, **71**, 79–81 (*Jan.* 15, 1947).—The theory of elementary particles permits one to attribute well-defined angular momentum expressions to a given radiation field. A few simple examples are discussed, which involve systems of two photons, and of one atom and one photon, and which permit one to account for the conservation of total angular momentum. Conservation of total angular momentum, including radiation, is, however, of little practical importance, because spatial orientation of a given system requires, in general, the use of external magnetic fields, which perturb the angular momentum balance. A.

30.145 : 539.152 1129

The hydrogen atom in a generalized classical electrodynamics. ELIEZER, C. J. *Phys. Rev.*, **71**, 49–53 (*Jan.* 1, 47).—See Abstr. 1793, 2766 (1946).

30.145.6 1130

Derivation of fundamental kinetic equation in quantum mechanics. VONSOVSKY, S. *J. Phys., USSR.*, **10** (*No.* 4) 7–76 (1946).—Requirements similar to the statistical statement of the classical theory—the principle of detail equilibrium (Stosszahlansatz)—are estimated. They must be satisfied by a quantum-mechanical ensemble obeying the kinetic equation. A.

30.145.63 1131

On a general condition of Heisenberg for the *S* matrix. KA, S. T. *Phys. Rev.*, **71**, 195–200 (*Feb.* 1, 1947).—It is shown that the *S* matrix for an attractive exponential potential, which possesses redundant zeros, does not satisfy a general condition of Heisenberg, and to ensure the validity the supplementary condition is introduced that the interaction potential should vanish for large distances from the scattering centre. It is shown that the above *S* matrices and the Coulomb potential cut off at large distance *R* give correctly both the eigenvalues of energy and the asymptotic behaviour of the wave functions for the *s* states in the limit $R \to \infty$. A.

30.145.63 : 537.122 1132

Mutual magnetic interactions of electrons. MARVIN, J. H. *Phys. Rev.*, **71**, 102–10 (*Jan.* 15, 1947).—The formulae for the matrix components of the mutual spin-orbit and spin-spin interactions of 2 electrons are derived from Heisenberg's formula for the Hamiltonian function. The matrices of all 2-electron configurations of *s*, *p* and *d* electrons are computed. Numerical tables of certain functions of interaction integrals are given, which are useful in such calculations. A.

30.162 : 537.228.1 : 536.53 *see Abstr.* 1207

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

31.15 : 530.12 *see Abstr.* 1121

31.19 : 533.7 1133

The statistical mechanical theory of transport processes. I. Transport in gases. KIRKWOOD, J. G. *J. Chem. Phys.*, **15**, 72–6 (*Jan.*, 1947).—The Maxwell–Boltzmann integro-differential equation, underlying the well-developed Chapman–Enskog theory of transport phenomena in gases of low density, is derived from the principles of statistical mechanics [Abstr. 2043 (1946)]. A.

531.19 : 536.7 : 536.423.4 = 5 *see Abstr.* 1204

531.225 : 537.21 : 532.51 : 517.942.9 *see Abstr.* 1104

531.225 : 539.414 1134

Note on a boundary value problem of Reissner and Sagoci. SNEDDON, I. N. *J. Appl. Phys.*, **18**, 130–2 (*Jan.*, 1947).

531.382 1135

Centrifugal fields. BEAMS, J. W., AND YOUNG, J. L. *Phys. Rev.*, **71**, 131 (*Jan.* 15, 1947).—High rotational speeds with steel spheres of ~ 1 mm dia. have shown that the peripheral speed at the moment of explosion is the same for all radii, $\sim 10^5$ cm/sec. W. E. D.

531.51 1136

The gravitational field of a rotating cohesive system. CLARK, G. L. *Proc. Camb. Phil. Soc.*, **43**, 164–77 (*April*, 1947).—An examination of a periodic solution of the gravitational equations, which is valid throughout all space, and is such that the internal and external fields and their derivatives are continuous at the boundary of a spheroid rotating about an axis, not an axis of symmetry. At a great distance the results may be applied to determine the velocity of propagation of gravitational waves and the loss of energy of a rotating cohesive system [see Abstr. 1137 (1947)]. L. S. G.

531.51 1137

Note on the velocity of propagation of gravitation. CLARK, G. L. *Proc. Camb. Phil. Soc.*, **43**, 178–82 (*April*, 1947).—The world invariant $B^{\varepsilon}_{\mu\nu\sigma}B^{\mu\nu\sigma}_{\varepsilon}$ is calculated approximately; but a train of waves caused by the earth's motion round the sun is too complicated for analytical treatment, and instead, an examination is made of the train of waves due to a rotating cohesive system. It is concluded that the velocity is equal to that of light. L. S. G.

531.51 : 537.1 : 530.12 *see Abstr.* 1122

531.57 1138

The internal ballistics of a gun after shot ejection. CORNER, J. *Proc. Roy. Soc. A*, **188**, 255–72 (*Jan.* 30, 1947).—The motion of gas within the barrel is studied and a simple solution holds for muzzle velocities of the order of 3 000 ft/sec. Formulae obtained for the pressure at the breech and the rate of outflow, for times after shot ejection, agree well with experimental results. Simple modifications of earlier work make the results sufficiently accurate for practical purposes. L. S. G.

531.57 : 536.532 *see Abstr.* 1208

531.573 1139

The internal ballistics of a leaking gun. CORNER, J. *Proc. Roy. Soc. A*, **188**, 236–55 (*Jan.* 30, 1947).—The theory is developed for a gun in which the propellant gases can escape by a vent, whose area is a function of the time or travel. Important special cases are treated in detail, and the theory is applied to the testing and design of recoilless guns, to the leakage past the projectile in smooth-bore mortars and to the calculation of the loss of performance as a gun wears. The differential equations involved are solved numerically. L. S. G.

531.6 : 533.6 *see Abstr.* 1154

MECHANICAL MEASUREMENTS 531.7

531.754.6 1140

An apparatus for the determination of small changes in density. DOUGLAS, R. W., AND JONES, G. A. *J. Sci. Instrum.*, **24**, 72–5 (*March*, 1947).—Water is used as flotation liquid and the difference between its density and that of glass is compensated by means of a float. A mathematical discussion of the sensitivity and accuracy of the method is given, and a description of the technique by which changes in the density of glass specimens may be measured accurately to $\pm 0{\cdot}00002$ g/cm.^{3} A.

531.768 : 534.154 : 621.385.23 1141

Vacuum-tube acceleration pickup. RAMBERG, W. *J. Res. Nat. Bur. Stand., Wash.*, **37**, 391–8 (*Dec.*, 1946). *See also Rev. Sci. Instrum.*, **18**, 67–8 (*Jan.*, 1947).—The tube is a diode with fixed cathode, and anode elastically mounted (natural frequency ~ 800 c/s). Current changes are proportional to acceleration up to 200 c/s, and for accelerations of the order of 10 *g* can be observed on an oscilloscope direct. The tube has been applied to investigation of aircraft accelerations and vibrations. A.

531.788.7 = 4 1142

Measurement of very low pressures by the ionization gauge. BIGUENET, C. *Le Vide*, **1**, 174–6 (*Nov.*, 1946) *In French.*—Describes laboratory determinations of the characteristics of a number of ionization gauges of different design. The ion current was found to be proportional to the electronic current and to the ionizing distance, and the gauges were found to be most sensitive with grid at +250 V and plate at −30 V. The ideal gauge should have a larger electronic current than the usual 20 mA, the distance between grid and plate should be as large as possible, and the grid should be so shaped as to have a large surface for cooling purposes, but to intercept as few electrons from the filament as possible. N. C.

MECHANICS OF LIQUIDS 532

532 = 4 1143

An attempt at the definition of the perfect liquid. DUCLAUX, J. P. E. *Ann. Phys., Paris* (*Sér.* 12) **18**, 206–16 (*July–Sept.*, 1943) *In French.*

532.137 1144

A viscometer with constant working volume suitable for measurements over a wide range of viscosities. HARGREAVES, W. D. *Phil. Mag.* (*Ser.* 7) **36**, 756–8 (*Nov.*, 1945).—A diagram and constructional details of the viscometer are given. The instrument is an improvement on the simple Ostwald type in that it may be used over a wide range of viscosities, e.g. 2 to 100 millipoises. L. S. G.

532.51 : 537.21 : 531.225 : 517.942.9 *see Abstr.* 1104

CAPILLARITY 532.6

532.61.08 1145

A new type of precision capillarimeter. JASPER, J. J., AND HERRINGTON, K. D. *J. Amer. Chem. Soc.*, **68**, 2142–4 (*Nov.*, 1946).

532.61.08 : 541.183.3.08 1146

A simple film balance for demonstration and research processes. ALEXANDER, A. E. *Nature, Lond.*, **159**, 304–5 (*March* 1, 1947).

532.63 : 539.216 *see Abstr.* 1320

KINETIC THEORY OF LIQUIDS 532.7

532.7 1147

A general kinetic theory of liquids. II. Equilibrium properties. GREEN, H. S. *Proc. Roy. Soc. A*, **189**, 103–17 (*March* 27, 1947).—Previous work [Abstr. 771 (1947)] is extended. Boltzmann's *H*-theorem is generalized, and this allows the equilibrium properties of a fluid to be developed without appeal to statistical mechanics. The entropy of a fluid is first suitably defined, and it is proved that the entropy increases with time towards a certain maximum. The liquid state is distinguished from the gaseous state by the existence of real roots of a certain transcendental equation. Approximate expressions are found for the virial coefficients in the gaseous phase and an equation of state with two branches is derived. The branches are identified with the gaseous and liquid states. L. S. G.

532.7 1148

A kinetic theory of liquids. BORN, M., AND GREEN, H. S. *Nature, Lond.*, **159**, 251–4 (*Feb.* 22, 1947).—A short account of the methods and results of the theory published elsewhere [Abstr. 771, 1147 (1947)].

532.72 : 621.317.39 1149

An electrical device for investigating the diffusion of liquids. BLAKE, G. G. *J. Sci. Instrum.*, **24**, 77–9 (*March*, 1947).—The method of Abstr. 197 (1946) is applied to follow the diffusion of electrolyte up a vertical tube filled with water. Reliable results can be obtained in a few hours. A.

MECHANICS OF GASES 533

533.15 1150

The self-diffusion coefficient of uranium hexafluoride. NEY, E. P., AND ARMISTEAD, F. C. *Phys. Rev.*, **71**, 14–19 (*Jan.* 1, 1947).—This was measured by observing with a mass spectrometer the rate at which vapour material enriched in one isotope diffused into normal material. A value of ρD (ρ = density, D = diffusion constant) was obtained for UF_6 at 30°C. Knowledge of the viscosity allows calculation of the molecular force law. A.

533.15 : 533.7 *see Abstr.* 1156

533.15 : 533.7 : 539.155.2 *see Abstr.* 1273

[533.15 + 537.363] : 539.155.2 *see Abstr.* 1272

533.5 1151

New developments in vacuum engineering. JACOBS, R. B., AND ZUHR, H. F. *J. Appl. Phys.*, **18**, 34–48 (*Jan.*, 1947).—Methods developed for obtaining vacuum-tightness in the K-25 Gaseous Diffusion Plant for the separation of U^{235} are described. The dynamics of vacuum systems are described, including the use of the mass spectrometer leak detector [Abstr. 1153 (1947)] on rapidly responding systems. New techniques described include the He hood method for measuring vacuum tightness, and the use of calibrated leaks. A.

533.5 1152

Protective device for oil diffusion pumps. AMDUR, I. *Rev. Sci. Instrum.*, **18**, 66 (*Jan.*, 1947).—The arrangement described uses an adjustable, bellows type pressure switch which opens the pump heater circuit when the water pressure drops below a safe value, and a thermocouple gauge which closes a sensitive relay when the gas pressure rises above the maximum allowable forepressure value.

533.5 : 538.691 1153

Mass spectrometer for leak detection. NIER, A. O., STEVENS, C. M., HUSTRULID, A., AND ABBOTT, T. A. *J. Appl. Phys.*, **18**, 30–3 (*Jan.*, 1947).—A simple low-resolution instrument is described. One part of He in 200 000 parts of air can be detected in high vacuum equipment. A.

533.6 : 531.6 1154

The propulsive force produced by an intermittent jet of gas. KASTNER, L. J. *Phil. Mag.*, **37**, 411–20 (*June*, 1946).—The propulsive force is found by a simple method, involving a momentum principle, and a numerical example is worked out in detail. The exhaust jet in a conventional aircraft provides such a propulsive force. L. S. G.

533.6 : 551.554 *see Abstr.* 1373

533.6.07 : 629.13 : 621.316.17 1155

150 000 horsepower applied to aeronautical research. WHITE, J. A. *Trans. Amer. Inst. Elect. Engrs*, **65**, 833–9 (*Dec.*, 1946).—[Abstr. 1128 B (1947)].

KINETIC THEORY OF GASES 533.7

.7 : 531.19 *see Abstr.* 1133

.7 : 533.15 1156

Thermal diffusion in mixtures of the inert gases. GREW, E. *Proc. Roy. Soc. A*, **189**, 402–14 (*May* 1, 1947).—asurements have been made of the separation produced thermal diffusion in all the binary mixtures of the inert es (except Kr–X and Rn mixtures) at temperatures ging from −180 to 400°C. The results have been com- ed with those calculated by Jones [Abstr. 1700 (1941)] a gas mixture of two molecular species having ntical force fields of the Lennard-Jones type. It pears that the observed behaviour could be explained such a model if the force indices were suitably chosen, l that a study of the temperature dependence of thermal usion in isotopic mixtures would enable the indices to determined with some precision. A.

3.7 : 533.15 : 539.155.2 *see Abstr.* 1273

3.75 : 536.71 1157

On the equation of state for gases at extremely high essure. CALDIROLA, P. *J. Chem. Phys.*, **14**, 738–41 *ec.*, 1946).—On the basis of the thermo-hydrodynamic ory of the explosive detonation [Abstr. 1481 (1922)] procedure is developed permitting the deduction of the uation of state for gaseous mixtures up to 10^4–10^5 atmos. m explosive processes. The results of numerical iculations are reported. A.

VIBRATIONS . ACOUSTICS 534

4.112 1158

Forced vibrations of a whirling wire. MASKET, A. V. *il. Mag.*, **37**, 426–32 (*June*, 1946).—A Laplace transform ethod is used to solve the partial differential equation verning the vibrations. The wire is subject to a com- ned static tension and centrifugal force, the moving end ecuting a sinusoidal motion. L. S. G.

4.133 : 537.228.1 1159

General dynamical considerations applied to piezo- ectric oscillations of a crystal in an electrical circuit. WANN, W. F. G. *J. Franklin Inst.*, **242**, 167–96 (*Sept.*, 946).—The general solution of the forced and free scillations of an *X*-cut crystal in an electrical circuit is onsidered for the case in which there is internal damping determined by the rate of change of strain) in the crystal n addition to the electrical and mechanical damping. An intuitive approach allows a better physical inter- retation of the dynamic behaviour of the crystal. Resonance phenomena are fully discussed and the difference between the resonance frequency and the natural frequencies of the crystal is shown to be <0·01% n a typical case. H. J. H. S.

534.154 : 621.385.23 : 531.768 *see Abstr.* 1141

534.222.2 1160

The possibility of the rarefaction shock waves. ZELDO- VICH, J. *J. Phys., USSR*, **10** (*No.* 4) 325–6 (1946).— t is shown that for the gases with a large molar heat capacity C_v (> ~ 20 cal/deg. mole) there exists a region where rarefaction waves must propagate in the form of shock waves and compression waves must be blurred in the course of propagation. A.

534.222.2 1161

Propagation of spherical shock waves in water. COLE, R. H., AND COLES, J. S. *Phys. Rev.*, **71**, 128–9 (*Jan.* 15, 1947).—Experiments confirm results of Osborne and Taylor [Abstr. 50 (1947)] that the attenuation of the shock wave is in excess of an inverse first power of the distance, but disagree with the results of these authors in that a broadening of the shock wave with distance is observed. W. E. D.

534.222.2 : 534.24 *see Abstr.* 1164

534.222.2 : 541.126 *see Abstr.* 1338

534.222.2 : 541.127.4 : 539.132 1162

The propagation of shock waves in gas with reversible chemical reactions. ZELDOVICH, J. *J. Phys., USSR*, **10** (*No.* 4) 321–4 (1946).—The propagation of shock waves in a gas with a reversible chemical reaction or with retarded excitation of part of the heat capacity is considered. These peculiarities of the gas induce a great expansion of the shock wave front. The front structure depends upon the wave amplitude and this effect can be used in the investigation of the energy transfer to the inner degrees of freedom of molecules. A.

534.232 1163

A contribution to the theory of acoustic radiation. BOUWKAMP, C. J. *Philips Res. Rep.*, **1**, 251–77 (*Aug.*, 1946).—The field of radiation in an ideal medium produced by a harmonically oscillating membrane with arbitrary amplitude distribution in a closely fitting aperture of an infinite rigid plane is studied mathematically. The problem is stated by means of the velocity potential in the form of a boundary value problem in connection with the wave equation. A new argument is given as to why the time factor $\exp(-i\omega t)$ is preferred. The general formulae are applied to a circular membrane, and King's theory is very much extended. A.

534.24 : 534.222.2 1164

The normal reflection of shock waves. FINKELSTEIN, R. *Phys. Rev.*, **71**, 42–8 (*Jan.* 1, 1947).—The problem is solved by an approximate analytical integration of the hydrodynamical equations. It is found that in compressible fluids (gases) the pressure on the reflector is prolonged and the impulse delivered to it > the value predicted by the acoustic theory. In slightly compressible media (liquids and solids), the blow is shorter and the impulse delivered to the reflector < predicted. A.

534.321.9 : 535.42 *see Abstr.* 1195

534.837 : 621.314.2.019 1165

Emission of noise from transformers and reactors. FORREST, J. S. *Conf. Int. Gr. Rés. Élect.* [*CIGRÉ*] (*Rep. No.* 129) 16 *pp.* (1946).—[Abstr. 1092 B (1947)].

534.845 1166

Functional sound absorbers. OLSON, H. F. *RCA Rev.*, **7**, 503–21 (*Dec.*, 1946).—Apparatus for the measurement of direct-current acoustic resistance, acoustic impedance and the sound absorption characteristic of functional sound absorbers is described. Functional sound absorbers of 4 different sizes and 4 different shapes have been built and tested. The absorption coefficient is ~2× that of conventional materials. A.

534.862.4 : 621.395.623.7 1167

Sound amplification by air-stream modulation. MCQUAY, J. *Radio News*, **36**, 39, 137–8 (*Dec.*, 1946).—[Abstr. 1267 B (1947)].

OPTICS . RADIATION . SPECTRA 535

535.13 : 538.56 1168

The reflection of an electromagnetic plane wave by an infinite set of plates. I. CARLSON, J. F., AND HEINS, A. E. *Quart. Appl. Math.*, **4**, 313–29 (*Jan.*, 1947).—A plane wave is incident upon an infinite set of staggered, equally spaced, semi-infinite metallic plates of zero thickness. Plane waves are reflected in certain directions (depending

upon the geometry of the system) and these are investigated by an integral-equation method. The equation is solved by means of a Fourier transform. Expressions for the reflection coefficients are obtained and the far field is investigated. L. S. G.

535.14 : 530.145 *see Abstr.* 1128

535.23.08 1169

A fast and sensitive dielectric bolometer of new material and construction. EWLES, J. *J. Sci. Instrum.*, **24**, 57–61 (*March*, 1947).—An approximate theoretical treatment of the behaviour of metal-on-film-dielectric bolometers and thermo-junctions enables the speed and sensitivity to be estimated, and indicates that the dielectric bolometer used with an a.c. bridge and valve amplifier is the more sensitive instrument. A description is given of the construction and performance of such a bolometer of new material and design. With films as thick as 5×10^{-4} cm a sensitivity of 330 V/W in air, and a speed of 60% response in $\frac{1}{2}$ sec is indicated. A.

535.24 : 521.038 *see Abstr.* 1107

535.241 : 53.081 1170

A study of photometric nomenclature. MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, **36**, 666–75 (*Nov.*, 1946).—A development of a system of nomenclature previously proposed, extending it to include the analogous radiometric concepts. J. W. T. W.

535.241.14 : 535.568 = 4 *see Abstr.* 1199

535.31 : 535.513 1171

Geometrical optics and Maxwell's equations. FRIEDLANDER, F. G. *Proc. Camb. Phil. Soc.*, **43**, 284–6 (*April*, 1947).—It is shown that the intensity law of geometrical optics may be obtained by considering the asymptotic behaviour of the solutions of the wave-equation when the wavelength tends to zero. The variation of the direction of polarization in an inhomogeneous medium is discussed. If the medium is homogeneous and grad $K = 0$, where K is the permittivity, the polarization remains constant along a ray. L. S. G.

535.315 : 535.33.072–15 *see Abstr.* 1174

535.317 1172

Telescope objective without spherical aberration for large apertures, consisting of four crown glass lenses. FULCHER, G. S. *J. Opt. Soc. Amer.*, **37**, 47–54 (*Jan.*, 1947).—A telescope objective of 10-cm focal length may be produced with practically zero spherical aberration for all wavelengths of the visible spectrum and for apertures up to $f/2$ by combining four thin lenses of crown glass ($n = 1{\cdot}523$) of the same converging power. The lens surface curvatures approximate those of minimum aberration lenses but are in integral half diopters as follows: 1st lens, 2·5 and 0 diop.; 2nd, 4 and −1·5 diop.; 3rd, 6 and −3·5 diop.; and 4th, 7·5 and −5·0 diop. Detailed results are given for the linear spherical aberration. A.

535.321 : 535.412 *see Abstr.* 1191

535.33.072–15 1173

A recording vacuum grating spectrometer for the infra-red. BELL, E. E., NOBLE, R. H., AND NIELSEN, H. H. *Rev. Sci. Instrum.*, **18**, 48–56 (*Jan.*, 1947).

535.33.072–15 : 535.315 1174

Comparison of LiF and CaF_2 prisms for infra-red use. GORE, R. C., MCDONALD, R. S., WILLIAMS, VAN Z., AND WHITE, J. U. *J. Opt. Soc. Amer.*, **37**, 23–8 (*Jan.*, 1947).

535.337 : 535.343.4–14 : 539.152.2 *see Abstr.* 1269

535.337 : 537.228.5 : 538.615 1175

Effect of crossed electric and magnetic fields on the helium spectrum. FOSTER, J. S., AND POUNDER, E. R. *Proc. Roy. Soc. A*, **189**, 287–95 (*May* 1, 1947).—A double canal-ray tube is described, which provid opposing beams in the region between the pole face Here small field plates are set up to establish stro electric fields perpendicular to the canal rays. Light taken out at right angles to both fields and analysed by 6-prism glass spectrograph. Displacements and qual tative intensities are tabulated mainly for componen of 3 line groups round $\lambda\lambda$4922, 4472 and 4026 respectivel $H = 25\,800$ oersteds while $E = 10$–131 kV/cm. Resolve components remain sharp at all field strengths. A fe components correspond to $\Delta m = \pm2$; but there is n evidence for $\Delta m = \pm3$. Intensities of many componen are critically dependent upon electric field strength, an in at least one notable case (2^3P–5^3G) displacements ar similarly dependent. The latter is attributed to repulsio between levels of different m values which nevertheles are forced to cross over each other. A

535.338 : 525.75 = 4 117

Contribution to the study of the spectrum of molecula nitrogen. HERMAN-MONTAGNE, R. *Ann. Phys., Pari (Sér.* 12) **20**, 241–91 (*May–June*, 1945) *In French.*—Th Lyman system is extended to longer λ; improved data fo the ground state to $v = 27$ give a better extrapolation t the dissociation limit. Several new systems are obtained including five in the quartz u.v. due to transitions t $a^1\Pi$. The interpretation of Kaplan's and van der Ziel' bands is discussed. The mechanism of excitation an intensity distribution in systems of N_2 are examined The spectrum of N_2 is compared with that of the nigh sky. [See also Abstr. 1853 (1946)]. A. G. G

535.338.334 117

Pressure broadening in the infra-red and optical collisio diameters. COGGESHALL, N. D., AND SAIER, E. L *J. Chem. Phys.*, **15**, 65–71 (*Jan.*, 1947).—The pressure-broadening effects of a number of foreign gases on the infra-red absorption of CH_4 at 7·65 μ and of CO_2 a 4·3 μ and 14·8 μ have been investigated. The data have been analysed to obtain optical collision diameters (any collision effective in interrupting the processes of radiation absorption). The data confirm the Lorentz theory. The pressure broadening effects of certain gases on one absorber cannot be reliably extrapolated to predict the effects on another. Also the effects at one wavelength are not in general the same at another for the same absorber. Empirical results on the shape of the curves obtained are presented. The deviation from Beer's law of absorption evidenced by isobutylene at 11·23 μ is shown to be not due to pressure broadening. A.

535.338.4 : 542.921.4 1178

The spectra of flames containing oxides of sulphur. GAYDON, A. G., AND WHITTINGHAM, G. *Proc. Roy. Soc. A*, **189**, 313–25 (*May* 1, 1947).—Observations of hydrocarbon and related flames containing small amounts of SO_2 and SO_3 have been made with a view to elucidating the mechanism of C formation in flames. Band systems due to S_2, SO, CS and SH occur; this is the first record of the SH band in emission. The mechanism of the formation of these radicals is discussed. SO_3 increases C deposition in hydrocarbon flames and it is considered that it can induce chain reactions leading to the polymerization and decomposition of hydrocarbons. SO_2 and H_2S, which reduce C deposition, either inhibit the chain processes or remove C as soon as it is formed. A.

535.339.1 1179

The construction and performance of a large grating monochromator with a high energy output for photochemical and biological investigations. FRENCH, C. S., RABIDEAU, G. S., AND HOLT, A. S. *Rev. Sci. Instrum.*, **18**, 11–17 (*Jan.*, 1947).—A simple monochromator with

×6 in replica grating f : 3·4, which covers the range –1 000 mμ is described. The dispersion is 3·55 mμ/mm he 2nd order and 7·1 mμ/mm in the 1st. The slits are d in position and the wavelength of the emergent beam aried by rotating a mirror located between the telescope s and the exit slit. With a 2×34-mm entrance slit it duces 4×10^{-2} cal/min of red light with a band-width bout 28 mμ from a 350-W tungsten lamp. A.

.343 : 537.531 *see Abstr.* 1228

.343.2 : 535.372 *see Abstr.* 1187

.343.4–14 1180

The inversion spectrum of ammonia at centimetre wavegths. BLEANEY, B., AND PENROSE, R. P. *Proc. Roy. . A*, **189**, 358–71 (*May* 1, 1947).—A technique is cribed for the investigation of gaseous spectra at high io-frequencies. The sensitivity is such that an orption of 2×10^{-6}/cm of path can be detected at velengths around 1 cm. The inversion spectrum of H_3 in the ground vibrational state has been examined at velengths between 1·1 and 1·6 cm and found to conn an extensive fine structure, arising from centrifugal tortion of the molecule. Twenty-nine lines have been ntified, each corresponding to a different rotational antum state, and the wave numbers of these have been curately fitted to a formula. The ½-widths of 18 lines a pressure of 0·5 mm Hg, due to collision broadening, between 2 and 5×10^{-4} cm^{-1}, while their intensities ree with the theoretical values, within the experimental or of ±5%. The integrated intensity at a pressure of 5 mm Hg, over the interval 0·67 to 0·87 cm^{-1}, agrees h the calculated intensity to better than 1%. A.

5.343.4–14 1181

Hyperfine structure of the microwave spectrum of mmonia and the existence of a quadrupole moment in N^{14}. AILEY, B. P., KYHL, R. L., STRANDBERG, M. W. P., N VLECK, J. H., AND WILSON, E. B. *Phys. Rev.*, **70**, 4 (*Dec.* 1 *and* 15, 1946).—Measurements of the hyper- e structure of the inversion spectrum of $N^{14}H_3$ were ade in the region of 1·25 cm, and theoretical calcula- ons are made on the assumption that the existence of this ructure is due to an interaction of the quadrupole oment of N^{14} with the electrical field of other charges in e molecule. Theory and experiment are in good agree- ent. As N^{15} has a nuclear spin of ½ it should show no perfine structure, and its absence was confirmed perimentally. [See also Abstr. 1182 (1947)]. W. E. D.

35.343.4–14 : 535.337 : 539.152.2 *see Abstr.* 1269

35.343.4–14 : [537.228.5 + 538.615] 1182

Stark and Zeeman effects in the inversion spectrum of mmonia. COLES, D. K., AND GOOD, W. E. *Phys. Rev.*, , 979 (*Dec.* 1 *and* 15, 1946).—Both effects were obrved and measured at $\lambda\simeq1{\cdot}25$ cm. The hyperfine ructure of the rotational lines was also resolved. [See so Abstr. 827 (1947)]. W. E. D.

35.343.4–14 : 539.133 1183

Rotational spectra of some linear molecules near 1-cm avelength. TOWNES, C. H., HOLDEN, A. N., AND FERRITT, F. R. *Phys. Rev.*, **71**, 64 (*Jan.* 1, 1947).— bsorption measurements were made with BrCN, ICN and OCS. The first two gases each had a strong air of lines attributed to similar rotational transitions in $Br^{79}CN$ and $Br^{81}CN$, and $Cl^{35}CN$ and $Cl^{37}CN$. Moments f inertia are computed to be: $Br^{79}CN$, 203·64; $Br^{81}CN$, 04·83; $Cl^{35}CN$, 140·47; $Cl^{37}CN$, 143·45; and OCS, $37{\cdot}93\times10^{-40}$ g cm^2. These values strongly suggest ne structures Br–C–N, and Cl–C–N; and the bond istances of 1·15 Å for C–N, 1·79 Å for Br–C, and 1·64 Å or Cl–C here obtained are in good agreement with those derived from electron diffraction experiments. The strong pair of rotational lines appearing with both BrCN and ClCN are accompanied by a number of unexplained weaker lines. W. E. D.

535.343.4–31 1184

Ultra-violet absorption spectrum of nitric oxide. BERNSTEIN, H. J., AND HERZBERG, G. *J. Chem. Phys.*, **15**, 77 (*Jan.*, 1947).—The only discrete band observed in experiments down to λ2200 using a long absorption path was the 0–1 band of the γ system, and the $^4\Pi\leftarrow{}^2\Pi$ transition was not detected.

535.37 : 548.73 1185

Thermal and X-ray analyses of some common phosphors. NAGY, R., AND CHUNG KWAI LUI. *J. Opt. Soc. Amer.*, **37**, 37–41 (*Jan.*, 1947).—The exothermic and endothermic reactions of the phosphors were correlated with the fluorescent output and X-ray diffraction patterns. The maximum output of fluorescence was obtained from well-crystallized phosphors with sharp X-ray diffraction lines. The analyses have been used to elucidate the changes which occur in the formation of phosphors, and in determining their proper firing temperatures. A.

535.371.07 : 778.3 : 621.385.832 1186

Cathode-ray tube screens for photographic oscillography. HOPKINSON, R. G. *Photogr. J.*, **86 B**, 142–53 (*Nov.–Dec.*, 1946).

535.372 : 535.343.2 1187

The effect of temperature on the absorption and fluorescence spectra of impurity crystals. GANGULY, S. C. *Indian J. Phys.*, **19**, 222–4 (*Dec.*, 1945).—At 180°c a new absorption band was observed in green anthracene crystals. As the temperature is lowered below room temperature the absorption bands become more and more intense and fluorescence bands sharper; and vice versa. A.

535.375.54 1188

Raman spectrum of rock-salt under high resolution. KRISHNAN, R. S.; BORN, M. *Nature, Lond.*, **159**, 266–7 (*Feb.* 22, 1947).—See Abstr. 1865 (1946).

535.375.54 : 548.7 *see Abstr.* 1353

535.375.55 1189

The Raman spectrum of hexafluoroethane. RANK, D. H., AND PACE, E. L. *J. Chem. Phys.*, **15**, 39–40 (*Jan.*, 1947).

535.393 1190

Reflectivity of steel. WEIL, R. *Nature, Lond.*, **159**, 305 (*March* 1, 1947).—Experimental results are reported, including values of the temperature coefficient, for two stainless steels. The nature of the tarnishing at high temperatures is discussed. One steel had an X-point [Abstr. 802 (1947)] at 0·65 μ.

535.412 : 535.321 1191

Interference fringes due to a wedge of air or liquid between two glass plates, in theory and practice. SEARLE, G. F. C. *Phil. Mag.*, **37**, 361–89 (*June*, 1946).—The source of light is a Na flame a few cm from the plates, of area ~2 cm^2. Path differences are calculated in an ideal case and exact results are obtained; this forms a basis for the discussion of practical cases. Various experiments, investigating or using the fringes, are described, and one of these provides a method for determining the refractive index of a liquid. L. S. G.

535.417 : 535.515 : 549.623.5 : 548.572 1192

New contributions to interferometry. Part VII. Monochromatic and white-light multiple beam interferometric studies on mica. TOLANSKY, S. *Phil. Mag.*, **37**, 390–8 (*June*, 1946).—Thin mica sheets coated on both sides with high reflecting Ag were used and 3 multiple beam methods employed: (*a*) monochromatic Fizeau fringes, (*b*) new white-light fringes of equal chromatic order, (*c*) new

monochromatic non-localized fringes. The mica surfaces were greatly distorted, but the contours followed one another, so the surfaces were effectively parallel. Method (*b*) permits a determination of (1) total mica thickness, (2) height and absolute direction of cleavage steps, (3) formation of surface topography, etc. Changes in the mica surface are discontinuous and a single "molecular" lattice (20 Å.) can be evaluated. The birefringence of cleaved mica sheets is studied. L. S. G.

535.42 1193

Talbot's bands. PIDDUCK, F. B. *J. Opt. Soc. Amer.*, **37**, 55–8 (*Jan.*, 1947).—The diffraction of a glass sheet is caused by the Hertzian oscillators in it, which alone can explain plausibly how light can change its direction. This theory is applied to the analysis of Talbot's bands, though Struve's analysis on the old theory is almost correct.

535.42 = 4 1194

Electromagnetic theory of diffraction at a slit. SAVORNIN, J., AND LAURENTJOYE, R. *Rev. Opt. (Théor. Instrum.)* **25**, 73–81 (*April–June*, 1946) *In French.*—Schwarzschild's treatment is examined, and it is shown that omission of the second term (corresponding to the effect of reflection) gives results largely in agreement with classical theory. The treatment is entirely mathematical. A. H.

535.42 : 534.321.9 1195

Diffraction of light by high-frequency ultrasonic waves. BHAGAVANTAM, S., AND RAMACHANDRA RAO, B. *Nature, Lond.*, **159**, 267 (*Feb.* 22, 1947).—Diffraction by progressive waves of frequency >100 Mc/s in water was only observed when the light rays were slightly inclined (52′) to the acoustic wave front; adjustment of the angle was critical, and the first order was then observed on one side only. The diffraction effect appears very like Bragg reflection at these frequencies, but is more normal at lower frequencies.

535.42 : 551.593.64 1196

A theory of the anti-coronae. VAN DE HULST, H. C. *J. Opt. Soc. Amer.*, **37**, 16–22 (*Jan.*, 1947).—The anti-coronae, or luminous rings around the anti-solar point, are explained as a peculiar diffraction phenomenon in small water drops. The optical and the electromagnetic theories give results in agreement with each other and with the observations. The most important features are those which relate to the polarization. A.

535.421 1197

Optical theory of the echelette grating. CONN, G. K. T. *Proc. Camb. Phil. Soc.*, **43**, 240–53 (*April*, 1947).—Expressions are derived for the wavelength relationship, the dispersion and the resolving power of spectrometers using these gratings (in the infra-red). The intensity distribution is discussed, especially in the case of a particular spectrometer fitted with a grating of 1 200 lines/inch. The properties of the gratings when used in much higher orders of interference than are common at present are considered. This is of practical importance with large aperture spectrometers. L. S. G.

535.43 : 537.531 : 548.7 *see Abstr.* 1354–5

535.513 : 535.31 *see Abstr.* 1171

535.514.3 = 4 1198

Polarizing prisms using a lamina of sodium nitrate. HUOT DE LONGCHAMP, M. *Rev. Opt. (Théor. Instrum.)* **26**, 94–8 (*March–April*, 1946) *In French.*—A thin crystalline plate of $NaNO_3$, cut parallel to its optic axis, is placed between two glass prisms with the optic axis parallel to the edges of the prisms, and cemented together with a material of refractive index such that the ordinary ray traverses the prism without deviation, the extraordinary ray being internally reflected. Although th vibration direction is the same as that in a Glazebrool the prism differs from the latter in that the beam anastigmatic, the angular field is extended and the en faces are invariable. The possibility of use in the ultr violet is mentioned. [See Abstr. 2572 (1945)]. H. G.

535.515 : 549.623.5 : 548.572 : 535.417 *see Abstr.* 1192

535.568 : 535.241.14 = 4 119

Theory of the Cornu photo-polarimeter. SMOSARSKI, W *Rev. Opt. (Théor. Instrum.)* **23**, 169–79 (*July–Sept.*, 1944 *In French.*—The theory is developed from physiologica optical principles, dealing with the fundamental relation ship, sensitivity of the equalization of the image bright ness, apparatus constants, degree of polarization, lov polarization, chromatic polarization, variable field o light and finally suggesting improvements in the appara tus. It is shown that the diaphragm images are propor tional to the expressions $i = (p\cos^2\varepsilon + q\sin^2\varepsilon)\cos^2\omega$ and $j = (p\sin^2\varepsilon + q\cos^2\varepsilon)\sin^2\omega$ when a section of th birefringent prism makes the angle ε with a principa plane of the luminous ray and angle ω with the sectio of the Nicol prism. All the applications of the apparatu are given by the equation $i = j$ which obtains when th images are equal in brightness. The precision of adjust ment of the instrument is shown to be different, dependen upon the method by which the adjustment is performed. R. C. F

535.653.3 = 4 120

Trichromatic colorimeter. BLOTTIAU, F. *Rev. Opt (Théor. Instrum.)* **25**, 209–18 (*Sept.–Oct.*, 1946) *In French* —A complementary illumination is superposed on the radiation from the surface under examination, so that the resulting field is always of the same apparent dimensions, colour and brilliance. The nature of the original radiation is deduced from measurements of the three added components. It is claimed that errors produced by variations in the properties of the eye are reduced to a minimum. A. H.

535.661.3 : 548.73 1201

X-ray diffraction studies of color variation of iron oxide pigments. BIRNBAUM, H., COHEN, H., AND SIDHU, S. S. *J. Appl. Phys.*, **18**, 27–9 (*Jan.*, 1947).—Samples of synthetic Fe_2O_3 (Goethite) taken at regular intervals from a 12-day continuous process showed progressive change of colour from pale yellow to dark brown. X-ray diffraction, electron microscope, and optical microscope studies indicate that the colour change in these samples is mostly caused by particle growth. A.

535.8 1202

An autocollimator for precise measurement of the flange focal distance of photographic lenses. TOWNSLEY, M. G., AND FOOTE, P. C. *J. Opt. Soc. Amer.*, **37**, 42–6 (*Jan.*, 1947).

535.89 : 621.325.13 1203

Spectral and modulation characteristics of the concentrated-arc. HUXFORD, W. S., AND PLATT, J. R. *J. Opt. Soc. Amer.*, **37**, 10–15 (*Jan.*, 1947).—[Abstr. 1188 B (1947)].

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536.413 : 541.57 : 548.736 *see Abstr.* 1365

536.42 : 541.183.5 *see Abstr.* 1344

536.421.4 : 551.574.7 *see Abstr.* 1374

536.423.4 : 536.7 : 531.19 = 5 1204

On the condensation phenomenon of Bose–Einstein gas. GENTILE, G. *Ric. Sci.*, **12**, 341–6 (*March*, 1941) *In Italian.*—Einstein's fundamental equation is deemed to be an approximation and a modified equation is suggested

hich accounts for degeneration and condensation enomena of other than ideal gases. J. A. W.

6,44 : 537.561 = 3 *see Abstr.* 1235

6.463 = 4 1205

Contribution to the experimental determination of the ll in pressure in the "blue cone" of flames. VASILESCO, V. *n. Phys., Paris*, **18**, 190–208 (*July–Sept.*, 1943) *In French.*

6.5.081 = 3 1206

On the question of the dimensions of temperature. ÄMMERER, C. *Öst. Ingen. Arch.*, **1**, 54–8 (*July*, 1946) *German.*—In applying the methods of dimensional alysis to molecular relationships the advantage of garding one mole or one molecule as the fourth ndamental quantity (together with mass, length and me) and temperature as a derived magnitude is scussed. F. E. H.

6.53 : 530.162 : 537.228.1 1207

Possible use of Brownian motion for low temperature ermometry. BROWN, J. B., AND MACDONALD, D. K. C.; AWSON, A. W., AND LONG, E. A. *Phys. Rev.*, **70**, 76–8 (*Dec.* 1 *and* 15, 1946).—A criticism of the discussion f this subject by Lawson and Long [Abstr. 3146 (1946)] nd a reply. W. E. D.

36.532 : 531.57 1208

Application of the sliding thermocouple method to the etermination of temperatures at the interface of a moving ullet and a gun barrel. ARMI, E. L., JOHNSON, J. L., MACHLER, R. C., AND POLSTER, N. E. *J. Appl. Phys.*, **18**, 8–94 (*Jan.*, 1947).—C.r. oscilloscope e.m.f.-time records, btained from a travelling thermocouple junction formed y the bullet-bore interface, are interpreted in terms of nstantaneous temperatures. A.

36.63 : 539.11 *see Abstr.*

36.655 1209

Change of latent heat of vaporisation with temperature. U GOUQ-JEN. *Industr. Engng Chem.*, **38**, 923–6 *Sept.* 12, 1946).—Two new rules are presented and their derivations given. (*a*) The ratio of latent heats of aporization at two equal reduced concentrations of the quilibrium vapour, expressed in terms of π/θ (where π = reduced pressure, p/p_c, θ = reduced temperature, T/T_c), is the same for all liquids. It is believed that the verage deviation of the points from the water line is less han 3%. (*b*) The ratio of latent heats of vaporization at any two equal reduced temperatures is the same for all liquids. The new rules have the advantages of simplicity and general applicability to all liquids. H. H. HO.

536.658 : 541.183 *see Abstr.* 1343

THERMODYNAMICS 536.7

536.7 : 531.19 : 536.423.4 = 5 *see Abstr.* 1204

536.71 : 533.75 *see Abstr.* 1157

536.76 1210

On metastable states of equilibrium in thermodynamics. FINCK, J. L. *J. Franklin Inst.*, **243**, 1–12 (*Jan.*, 1947).—The reversibility of a process is shown to depend on the number of independent variables of a system, and when only 2 are considered for a single homogeneous closed phase, some states have to be characterized as metastable. By classifying systems on a basis of the number of types of transformation instead of phases, equations of state can be formulated which include the metastable states. A.

ELECTRICITY 537

537.1 : 531.51 : 530.12 *see Abstr.* 1122

537.122 : 530.145.63 *see Abstr.* 1132

537.122 : 539.132 *see Abstr.* 1260

537.123 : 537.591.1 *see Abstr.* 1238

537.21 : 531.225 : 532.51 : 517.942.9 *see Abstr.* 1104

537.226 : 538.213 : 621.3.013 1211

The electrical constants of a material loaded with spherical particles. LEWIN, L. *J. Instn Elect. Engrs, Pt III*, **94**, 65–8 (*Jan.*, 1947).—The paper investigates the values of permittivity and permeability of a mixture consisting of a homogeneous material in which particles are embedded. Formulae are found which are valid at high frequencies, so long as the size of the particle is small compared with the wavelength and the packing is not too great. Special cases treated are iron-dust cores and expanded dielectrics in which the "particles" are air bubbles. For ferromagnetic materials, weak fields only are assumed, so that the results refer to initial permeability. On account of the heterogeneity of the mixture, the permeability may become "lossy" (i.e. μ may be complex). Even when the substances are all non-ferromagnetic, the permeability of the mixture may depart from unity, or be complex. [See also Abstr. 110 (1946)]. A.

537.228.1 : 530.162 : 536.53 *see Abstr.* 1207

537.228.1 : 534.133 *see Abstr.* 1159

537.228.5 : 538.615 : 535.337 *see Abstr.* 1175

[537.228.5 + 538.615] : 535.343.4–14 *see Abstr.* 1182

ELECTRIC CURRENTS 537.3

537.311.3 : 537.312.62 1212

Electrical conductivity of Na–ammonia solutions at low temperatures. GIULOTTO, L., AND GIGLI, A. *Phys. Rev.*, **71**, 211–12 (*Feb.* 1, 1947).—Detailed experiments following the resistance changes with temperature in the neighbourhood of the solidification temperature point to a phenomenon depending on change of state rather than to superconductivity W. E. D.

537.311.32 : 539.11 : 549.212 1213

Energy bands in graphite. COULSON, C. A. *Nature, Lond.*, **159**, 265–6 (*Feb.* 22, 1947).—Calculations on the energies of the mobile electrons (π-electrons) in a single plane of the graphite lattice show that they lie in a band symmetrical about its mid point, which is a minimum of value zero. The complete band accommodates 2 electrons per atom, and is therefore only half-filled. In its basal plane, therefore, graphite may be called a true electronic semi-conductor.

537.311.32 : 541.183 : 621.315.56 1214

The effect of physical adsorption on the electrical resistance of activated carbon. MCINTOSH, R., HAINES, R. S., AND BENSON, G. C. *J. Chem. Phys.*, **15**, 17–27 (*Jan.*, 1947).—The change of electrical resistance of several rods of activated carbon on the adsorption of a variety of vapours has been determined. The direction and extent of the resistance change appear to depend upon the adsorbate. The hypothesis that the changes in resistance are due to the variations in contact resistance between the carbon granules does not appear to be adequate to explain the observations. A.

537.311.33 : 621.315.59 : 621.396.622.63 1215

Thermal ionization of impurity levels in semi-conductors. GOODMAN, B., LAWSON, A. W., AND SCHIFF, L. I. *Phys. Rev.*, **71**, 191–4 (*Feb.* 1, 1947).—The probability of ionization of an impurity level by thermal agitation in a semi-conductor is estimated by the use of a simple Debye model. It is found that the probability of ionization by one phonon decreases exponentially with the depth of the impurity level below the conduction band, approaching

zero as the energy separation becomes equal to $k\theta_D$. The probability of ionization by more than one quantum is also estimated by the use of an Einstein model. It appears that the probabilities so calculated may play an important role in determining the frequency dependence of the rectification efficiency in crystal rectifiers. A.

537.312.62 1216

The residual currents in discs made of superconducting metals and the related hysteresis phenomena. ALEKSEYEVSKY, N. *J. Phys., USSR*, **10** (*No.* 4) 360–6 (1946).

537.312.62 1217

Uranium not a superconductor. SHOENBERG, D. *Nature, Lond.*, **159**, 303 (*March* 1, 1947).—Investigation by the magnetic moment method showed only a very slight effect which suggested that only $\sim\frac{1}{2}\%$ by volume of the metal had become superconducting (perhaps U carbide impurity). The resistance method is misleading as a test.

537.312.62 : 537.311.3 *see Abstr.* 1212

537.322 = 397 1218

Experimental determination of Peltier-, Thomson- and Seebeck-effect by certain metals. HOLMQVIST, S. *Trans. Chalmers Univ. Tech., Gothenburg* (*No.* 6) 37 *pp.* (1942) *In Swedish.*—A description of apparatus and methods used in a series of measurements on Bi, Sb, Ni, Fe, Cd, Pb, Mn, Ag and Zn, from −80°C to 200°C. A compensation method was used for the Peltier and Thomson effects, the RI^2 effect balancing the cooling of the junction and of the unequally heated metal bars respectively. Combinations of 3 metals in triangle were also investigated. The results are given in tables and graphs, and sources of error are discussed. J. A. W.

537.361 : 541.183.54 1219

A proposed interpretation of the zeta-potential. ROBINSON, L. B. *J. Chem. Phys.*, **14**, 721–4 (*Dec.*, 1946).—The method used by Gurney and Fowler in explaining the interfacial potential at a metal-solution boundary is applied. This gives the ζ-potential as a straight line function of log (concentration), in agreement with the shape of the experimental curves. To obtain exact agreement between theory and experiment, it is proposed that the permittivity of the electrical double layer is about 0·6 that of the value for pure water. This assertion can be checked by accurate measurements on the surface conductance of solution of electrolytes. A.

[537.363 + 533.15] : 539.155.2 *see Abstr.* 1272

537.363 : 541.18 1220

On Smoluchowski's equation for the electrophoresis of colloidal particles. OVERBEEK, J. T. G. *Philips Res. Rep.*, **1**, 315–19 (*Aug.*, 1946).—The influence of the time-of-relaxation effect on the electrophoretic velocity of colloidal particles with a very thin double layer is shown to be negligible, so that the electrophoresis is adequately described by Smoluchowski's equation. A.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.525 1221

Effect of direct-current potential on initiation of radio-frequency discharge. VARELA, A. A. *Phys. Rev.*, **71**, 124–5 (*Jan.* 15, 1947).—A d.c. potential was superimposed on a r.f. potential in an attempt to facilitate a rapid initiation of gaseous discharge with the lowest possible r.f. potential, and to reduce the de-ionization time. The second object was achieved, but it was found that the d.c. decreased rather than increased the rate of initiation of the discharge. An explanation of this effect is suggested. W. E. D.

537.525 : 537.562 122

The surprising amount of energy which can be collecte from gases after the electric discharge has passed. RAYLEIGH. *Proc. Roy. Soc. A*, **189**, 296–9 (*May* 1, 1947).—Earlier experiments [Abstr. 3194 (1940)] were repeate under conditions making possible the measurement of th total amount of energy delivered to a Pt wire in a ga discharge by catalytic action on the discharge products This rose as high as 223 eV/molecule of gas present a low pressures, which is very much above the 36 eV afforded by the dissociation of all molecules and singl ionization of all atoms.

537.525.5 = 3 122

Theory of the high-current arc column. HÖCKER K.-H., AND FINKELBURG, W. *Z. Naturforsch*, **1**, 305–10 (*June*, 1946) *In German.*—The Elenbaas–Heller energy balance in the luminous glow is supplemented by a new term going beyond the Rompe–Schulze extension (energy transport resulting from the ionization of the gas molecules), which takes into account the energy transport due to the dissociation of the molecules in the interior of the discharge. The different parts of the energy transport are calculated. The energy balance equation in the case of a high-current arc can be integrated by means of a Bessel function. An average temperature of approx. 11 000°K is arrived at. A.

537.525.5 = 3 1224

On the axial-temperature of the low-current arc column. HÖCKER, K.-H. *Z. Naturforsch.*, **1**, 382–4 (*July*, 1946) *In German.*—It is shown that the axial temperature of a low-current discharge lies in the neighbourhood of such temperatures for which the "complete heat conduction coefficient" has a minimum. A.

537.525.5 = 3 1225

The importance of nitric oxide in relation to carrier density in a low-current arc column in air. HÖCKER, K.-H. *Z. Naturforsch.*, **1**, 384–7 (*July*, 1946) *In German.*—A calculation of the electron density is undertaken on the basis of thermal ionization while considering the ionization of NO. A relation between the known ionization potentials and the experimentally determined degree of ionization is found to occur. A.

537.525.5 : 538.551.25 1226

Spontaneous electrical oscillations in low-pressure arc discharge. GRANOVSKY, B., AND BYKHOVSKAYA, L. *J. Phys., USSR*, **10** (*No.* 4) 351–9 (1946).—The spontaneous oscillations of current and voltage in a discharge arising in a circuit, lacking both capacitance and inductance, were investigated. Four different modes of oscillations were observed, depending upon discharge conditions and especially upon whether the cathode spot was free or anchored. These oscillations may be random or regular, of acoustic or of supersonic frequency. The dependence of the frequency and peak values of these oscillations upon pressure, current magnitude and arc-gap spacing was investigated. The existence of oscillations with a free cathode spot is shown to be associated with its movements, whereas with an anchored spot the oscillations are concentrated primarily in the anode region, where they apparently originate. The probable mechanism of generation of the oscillations is discussed. A.

537.529 : 548.0 1227

Theory of dielectric breakdown in the alkali halides. MALMLOW, G., AND SEITZ, F. *Phys. Rev.*, **71**, 125–6 (*Jan.* 15, 1947).—Experimental results show that the breakdown potential in KBr is constant over the temperature region 220 to 300°K; thus the critical factor is not the ability of electrons in the conduction levels to overcome the collisions with the lattice but is some

nperature-independent quantity. It is suggested that
: condition for breakdown is that the field be suffi-
ntly strong to dissociate the excitons. W. E. D.

7.531 : 535.343 1228

X-ray absorption structure of $GeCl_4$ and $AsCl_3$. EPHENSON, S. T. *Phys. Rev.*, **71**, 84–7 (*Jan.* 15, 1947).—
ie fine structure on the short-λ side of the *K*-edges of
: and As has been measured with a double crystal
ectrometer of resolution sufficient to resolve all
ucture predicted by theory. Structure was obtained
oser to the edge than heretofore resolved, and was not
ogether in agreement with the theory. A.

7.531 : 535.43 : 548.7 *see Abstr.* 1354–5

7.533.7 1229

Proposed detector for high energy electrons and mesons. ETTING, I. A. *Phys. Rev.*, **71**, 123–4 (*Jan.* 15, 1947).—
n arrangement for collimating the light emitted along
e path of a fast electron or meson is described [Abstr.
)81 (1937)]. The collimator should be constructed of a
aterial which has a low atomic number, is trans-
arent, homogeneous, and has small dispersion and
high refractive index. Lucite, Plexiglass and LiF are
ound to be suitable materials. The light thus collimated
ould be picked up by a photo-multiplier. W. E. D.

37.533.8 : 621.385.1.032.216 1230

Secondary electron emission from oxide-coated cathodes. OMERANTZ, M. A. *J. Franklin Inst.*, **242**, 41–61 (*July*,
946).—[Abstr. 1233 B (1947)].

37.534 : 621.384.6 1231

Mono-energetic protons from a cyclotron. CREUTZ,
. C., AND WILSON, R. R. *Rev. Sci. Instrum.*, **17**, 385–8
Oct., 1946).—[Abstr. 1223 B (1947)].

37.534.75 1232

Theoretical range-energy values for protons in air and aluminium. SMITH, J. H. *Phys. Rev.*, **71**, 32–3 (*Jan.* 1,
947).

37.534.8 1233

Surface formation of lithium negative ions. SLOANE,
R. H., AND LOVE, H. M. *Nature, Lond.*, **159**, 302–3
(*March* 1, 1947).—Bombardment of Ni with Li^+ ions
was found to produce, among others, ions attributed
from the similarity of their abundance ratios to that of
the Li isotopes) to $^6Li^-$, $^7Li^-$, $^6Li^{16}O^-$ and $^7Li^{16}O^-$.
The latter has a mass/charge ratio of 23, and may have
been previously mistakenly reported as $^{23}Na^-$.

37.542 : 539.166.08 *see Abstr.* 1292

37.542 : 539.185 1234

Hydrogen recoil proportional counter for neutron detection. COON, J. H., AND NOBLES, R. A. *Rev. Sci. Instrum.*, **18**, 44–7 (*Jan.*, 1947).—A proportional counter
utilizing recoiling protons ejected from a thin hydrogen-
ous radiator by elastic collision with incident neutrons
is described. Comparison between experimental and
calculated curves for sensitivity *v.* neutron energy, and
sensitivity *v.* counting bias, indicate that the response of
the counter is calculable. It may be used as a directional
threshold neutron detector, the value of the threshold
being open to arbitrary choice. A.

37.561 : 536.44 = 3 1235

On a relation between the critical temperature and the ionization potential of the inert gases. BAGGE, E., AND
HARTECK, P. *Z. Naturforsch.*, **1**, 481–2 (*Sept.*, 1946) *In German.*—It is shown that the empirical relation
$T_k = -274{\cdot}5 + 6860/E_j$ holds between the critical
temperature, T_k,(°K), and the ionization potential,
E_j,(eV), of the inert gases. The plausibility of this
result is shown by quantum mechanics. F. L. J.

37.561 : 539.132 1236

Molecular dissociation by electron bombardment: a study of $SiCl_4$. VOUGHT, R. H. *Phys. Rev.*, **71**, 93–101
(*Jan.* 15, 1947).—The first part deals with the determination of appearance potentials of molecular fragments in
general from plots of ion current *v.* electron energy.
The value obtained by the intercept with the energy axis
of the extrapolation of the straight line portion of the
ionization efficiency curve corresponds quite closely to
the energy necessary to produce a transition through
the centre of the Franck–Condon region. The last
section contains an analysis of data obtained in a study
of the dissociation of $SiCl_4$. Ionization energies of
$SiCl_4$ and $SiCl_2$ measured directly were found to be
$11{\cdot}6 \pm 0{\cdot}2$ and $11{\cdot}8 \pm 0{\cdot}3$ V respectively. A.

537.561 : 541.57 *see Abstr.* 1345

537.562 : 537.525 *see Abstr.* 1222

537.564 : 523.53 : 551.510.535 *see Abstr.* 1371

537.564 : 539.132 *see Abstr.* 1261

537.564 : 539.156 *see Abstr.* 1276

COSMIC RAYS 537.591

537.591 : 539.152.1 *see Abstr.* 1266

537.591 : 539.18 *see Abstr.* 1313

537.591.1 1237

Note on the proton hypothesis of the primary component of cosmic rays. ARLEY, N. *Phys. Rev.*, **70**, 975–6 (*Dec.*
1 *and* 15, 1946).—It is contended that present experimental evidence appears to require another component
in the primary radiation in addition to the proton. W. E. D.

537.591.1 : 537.123 1238

Cosmic radiation and negative protons. ARLEY, N. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 7)
42 *pp.* (1945).—The author reviews experimental evidence
concerning the altitude variation of the components of
cosmic rays and the geomagnetic properties at sea level
and at high altitude, and discusses the bearing of the
results on the problem of the nature of the primary
cosmic radiation approaching the earth, concluding that
the assumptions of a purely electronic, a purely protonic
and a mixed electron-proton primary beam cannot be
reconciled with experimental data. The rejection of the
third alternative rests only on a result of Schien, Jesse
and Wollan [*Phys. Rev.*, **59**, 930 (1941)]. It is suggested
that the incident cosmic ray stream may consist in part
of negative protons, existing either free or, as proposed
by Klein [*Ark. Mat. Astr. Fys.*, **31 A** (*No.* 14) (1945)], as
"reversed matter" containing negative protons and
positive electrons. The negative protons would lead at
annihilation to the soft component of cosmic rays;
particular importance is therefore attached to the
experimental determination of the east-west assymmetry
of the soft component at very high altitudes. J. G. W.

537.591.15 1239

On the theory of the effects of the photon component in coincidence experiments on cosmic rays. ARLEY, N., AND
ERIKSEN, B. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*,
17 (*No.* 11) 56 *pp.* (1940).—The theory of the growth of
a cascade shower from a photon primary is developed,
following closely the treatment of the analogous problem
for an electron primary given by Arley [Abstr. 243
(1939)]. The fluctuations of the number of electrons
beneath a given absorber are treated according to the
energy of the primary photon; the Poisson formula is
applied to showers developed from photons above the
critical energy, while a particular treatment is given for
less energetic incident photons. A comparison is made

with experimental results by Rossi and Janossy [Abstr. 1529 (1940)], and agreement is good, provided that the experimental results are assumed to refer mainly to electrons above the critical energy. J. G. W.

537.591.15 1240

The beginning of the photon-initiated Rossi-curve for Pb, Fe and Al. TRUMPY, B. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 6) 10 *pp.* (1943).—An anti-coincidence method is used to measure the Rossi transition curve for cascade showers containing one or more electrons, initiated by photons unaccompanied by electrons falling on Pb, Fe and Al [see also Abstr. 1529 (1940)]. The results are shown to be in good agreement with the theoretical transition curves determined by Arley and Eriksen [Abstr. 1239 (1947)]. J. G. W.

537.591.15 1241

Density spectrum and origin of extensive atmospheric cosmic ray showers. COCCONI, G. *Phys. Rev.*, **70**, 975 (*Dec.* 1 *and* 15, 1946).—Experiments with coincident counters give results in agreement with Wolfenstein's calculations [Abstr. 1885 (1945)] on the basis of the cascade theory, and in contradiction with previous experimental results used by Wolfenstein for comparison. W. E. D.

537.591.15 = 5 1242

On the problem of fluctuations in cosmic ray showers. DELLA CORTE, M. *Nuovo Cim.*, **3**, 142–51 (*June*, 1946) *In Italian.*—Relative frequencies of showers with $N = 1, 2, 3 \ldots$ particles have been calculated on Arley's model under different thicknesses of Pb, and Rossi curves for such showers were determined experimentally, which confirmed Arley's model. The influence of the geometry of the apparatus is discussed, and divergencies of other investigators are attributed to this cause. A.

537.591.15 = 5 1243

On the large showers in cosmic rays at sea level. COCCONI, G. *Ric. Sci.*, **12**, 210–11 (*Feb.*, 1941) *In Italian.*—That large showers are responsible for the majority of coincidences recorded with 4 counters at considerable distances from one another, at sea level, is confirmed by photographs with a Wilson chamber, which are reproduced. J. A. W.

537.591.3 = 5 1244

An experiment under rock up to 575 m water-equivalent concerning hard and soft cosmic radiation components. BALLARIO, C., DELLA CORTE, M., AND PROSPERI, M. *Ric. Sci.*, **12**, 162–6 (*Feb.*, 1941) *In Italian.*—Using 3 groups, each of 2 counters in parallel, without and with 8·5 cm Pb interposed, the total number and the number of penetrating particles were counted. Results are tabulated and graphed. Full discussion follows later. J. A. W.

537.591.5 1245

Production of mesotrons up to 30,000 feet at a magnetic latitude of 22° north. GILL, P. S. *Phys. Rev.*, **70**, 82–4 (*Jan.* 15, 1947).—A fuller account of results reported in Abstr. 1910 (1946). See also Abstr. 2111 (1940). A.

537.591.5 = 3 1246

Effect of the magnetic storm of 1st March, 1941, on cosmic radiation. SITTKUS, A. *Z. Naturforsch.*, **1**, 204–8 (*April*, 1946) *In German.*—The effect was investigated by ionization chamber determinations at Freiburg, thus completing the observations of Kölhorster at Dahlem and Graz. There is a qualitative similarity, though the amplitude of the disturbance is different. The elimination of meteorological effects by comparison of results obtained at widely separated stations in Germany cannot therefore be guaranteed. A. J. M.

537.591.5 = 5 124

On the nature of the electronic component of cosm rays at 120 m and 2 200 m above sea level. COCCONI, G AND TONGIORGI, V. *Ric. Sci.*, **12**, 144–61 (*Feb.*, 1941) *Italian.*—Previous investigations on latitude, height an zenith angle (θ) effects on the ratio of electron (E) t meson (M) component are discussed. Three series o experiments are described, two at Milan (120 m) usin triple coincidence counters, one at Passo Sella (2 200 m using quadruple coincidence to minimize effect o showers. Apparatus is described in detail and result are tabulated and discussed. At sea level $E/M = 0{\cdot}20$ total electron radiation consists of an interaction com ponent I, a disintegration component D and a residuun of primary electron radiation R. E/M decreases at bot stations with θ; $D/R \simeq 1$; diffusion is negligible up t $\theta = 60°$. $I/M = 0{\cdot}05$ at sea level, $D/M \simeq R/M \simeq 0{\cdot}07$. J. A. W

537.591.8 = 5 124

On the production of secondary electron radiation by mesons. BERNARDINI, G., PANCINI, E., SANTANGELO, M. AND SCROCCO, E. *Ric. Sci.*, **12**, 321–40 (*March*, 1941) *Italian.*—Using very large counters, absorption and shower measurements were made at depths of 10 m and 75 m water equivalent, with open-air control measurements. The apparatus is described, results are tabulated and graphed and compared with previous investigations and with Williams's theory. The discordance is explained as due to the fact that not all the electrons are produced by mesons, some being generated by a non-ionizing component; alternatively, meson interaction with matter is more complex than the theory assumes. J. A. W.

537.591.8 = 5 1249

Some nuclear reactions of cosmic rays recorded on the photographic plate. BRUNETTI, R., AND OLLANO, Z. *Ric. Sci.*, **12**, 371–4 (*March*, 1941) *In Italian.*—Various traces on photographic plates are illustrated and analysed, attributed to α-particles, $_3Li^7$, $_1H^2$, $_1H^1$, and the energy values in MeV assessed. The results are discussed in the light of previous investigations. J. A. W.

MAGNETISM 538

538.124 1250

Note on magnetic energy. LIVENS, G. H. *Phys. Rev.*, **71**, 58–63 (*Jan.* 1, 1947).—A reply to criticism [Abstr. 1099 (1946)].

538.2 : 548.0 = 3 1251

Measurements on the influence of structural and configuration changes on magnetic susceptibilities. ZIMENS, K. E., AND HEDVALL, J. A. *Trans. Chalmers Univ. Tech. Gothenburg* (*No.* 9) 26 *pp.* (1942) *In German.*—Results are given of the examination of Al hydroxides and their derived active Al oxides. As expected, no connection was found between structure and susceptibility for a diamagnetic system. The susceptibilities are plotted to show their dependence on water content, and are compared with previous results. Other measurements show no variation of susceptibility with particle sizes (for TiO_2 and Se), with transition stages in crystallographic changes (for TiO_2 and S), and under illumination (for Se and ZnS-phosphors). Some difference was noticed, however, between crystallographically different modifications of TiO_2, S, Se, and ZnS as well as for Al_2O_3. The water in $Na_2CO_3 \cdot 10\,H_2O$ and $KAl(SO_4)_2 \cdot 4{\cdot}3\,H_2O$ behaves as an additive substance. G. F. H.

538.213 : 621.3.013 : 537.226 *see Abstr.* 1211

538.213 : 621.318.042.15 1252

Permeability of dust cores. BARDELL, P. R. *Wireless Engr*, **24**, 63 (*Feb.*, 1947).—[Abstr. 1181 B (1947).]

538.23 + 538.247 1253

Demagnetising coefficients and hysteresis losses of rectangular iron-silicon strips. SONDHEIMER, E. H. *Proc. Camb. Phil. Soc.*, **43**, 254–61 (*April*, 1947).—The coefficients (N) and losses were investigated experimentally. The hysteresis loss is approx. independent of the value of N, in agreement with a simple theory. The value of N for the inscribed ellipsoid was calculated and the actual value agrees fairly well with this. L. S. G.

538.247 + 538.23 *see Abstr.* 1253

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

538.3 = 3 1254

On the theory of the continuous electromagnetic field. KNEISSLER, L. *Elektrotech. u. Maschinenb.* [*EuM*], **63**, 72–8 (*March–April*, 1946) *In German.*—An extended and unified presentation of the continuous field theory following on previous papers [Abstr. 1195 B (1943)]. The various fundamental equations agree in form with those of the Lorentz electron theory. H. G. S.

538.551.25 : 537.525.5 *see Abstr.* 1226

538.56 : 535.13 *see Abstr.* 1168

538.567 : 621.396.671 1255

Slot aerials and their relation to complementary wire aerials (Babinet's principle). BOOKER, H. G. *J. Instn Elect. Engrs, Pt IIIA*, **93** (*No.* 4), 620–6 (1946).—[Abstr. 1300 B (1947)].

MAGNETIC EFFECTS 538.6

538.615 : 537.228.5 : 535.337 *see Abstr.* 1175

538.615 + 537.228.5] : 535.343.4–14 *see Abstr.* 1182

538.691 : 533.5 *see Abstr.* 1153

538.691 : 539.155.2 *see Abstr.* 1274

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 : 536.63 1256

Oscillator concept in the theory of solids. CORSON, E. M., AND KAPLAN, I. *Phys. Rev.*, **71**, 130–1 (*Jan.* 15, 1947).—The usual oscillator picture in the theory of specific heats is too literal, and instead the treatment must deal with the elastic oscillations as an ideal "phonon" gas which is formally described by an aggregate of ideal oscillators. W. E. D.

539.11 : 548.7 1257

Local quantum states of an electron in an ideal ionic crystal. PEKAR, S. *J. Phys., USSR*, **10** (*No.* 4) 341–6 (1946).—These states are formed in the following manner: A localized electron induces a dielectric polarization of the crystal; due to the polarization a potential well, which stationarily supports the electron in a localized state, is formed. In its turn the electron stationarily supports the polarization of the crystal. The stability of such self-consistent states is proved, their basic parameters, the energy of heat dissociation, and the long-wave limit of the photo-effect are calculated. A.

539.11 : 548.7 1258

Autolocalization of an electron in a dielectric inertially polarizing medium. PEKAR, S. *J. Phys., USSR*, **10** (*No.* 4) 347–50 (1946).—The energy of the ground state and the eigenfunction for the electron of the previous abstract are calculated. A.

539.11 : 549.212 : 537.311.32 *see Abstr.* 1213

539.132 1259

The relation between the force constant and the interatomic distance of a diatomic linkage. II. A modified Huggins relation. WU, C. K., AND CHAO, S. C. *Phys. Rev.*, **71**, 118–21 (*Jan.* 15, 1947).—[See Abstr. 1000 (1945)]. Huggins's relation [Abstr. 2747 (1936)] is modified so that the constants are now characteristic of the molecular period. The accuracy is slightly better. Various aspects are discussed. A.

539.132 : 537.122 1260

Excitation of molecular vibrations by electrons. WU TA-YOU. *Phys. Rev.*, **71**, 111–18 (*Jan.*, 1947).—The cross-section is calculated for two cases: (1) On the assumption that a molecule interacts with an electron through the oscillating electric moment arising from the vibration, the cross-sections of excitation and de-excitation are of the order $y^2 \cdot 10^{-15}$ cm^2 where $y \cdot 10^{-18}$ c.g.s. unit is the matrix element of the electric moment associated with the vibrational transition. (2) For optically inactive vibration, an approximate estimate of the cross-section in the case of the H_2 molecule is made by the method of distorted wave. The cross-section is of the order $0{\cdot}5 \cdot 10^{-18}$ cm^2 for electrons of a few volts. These results are compared with the experimental results on the probability of electron energy transfer to molecular vibrations. A.

539.132 : 537.561 *see Abstr.* 1236

539.132 : 537.564 1261

Mass spectrometric study of CH_3D. Dissociation probabilities of C–H and C–D bonds by electron impact. EVANS, M. W., BAUER, N., AND BEACH, J. Y. *J. Chem. Phys.*, **14**, 701–7 (*Dec.*, 1946).—A pure sample of CH_3D has been prepared and studied in the mass spectrometer. The mass spectrum of CH_3D cannot be predicted from that of CH_4 by assuming complete similarity between H and D (except mass). The difference in dissociation probability of C–H and C–D bonds is approximately constant for several ionization processes and over a considerable range in electron energy. In addition, there is a difference in behaviour of H atoms in CH_4 and in CH_3D, and a similar difference has been detected in the results of Delfosse and Hipple on $C_2H_2D_2$ [Abstr. 788 (1939)]. A.

539.132 : 541.127.4 : 534.222.2 *see Abstr.* 1162

539.133 : 535.343.4–14 *see Abstr.* 1183

539.133 : 541.57 *see Abstr.* 1346

539.152 : 530.145 *see Abstr.* 1129

539.152.1 1262

Energy levels in the nucleus Mn^{56}. MARTIN, A. B. *Phys. Rev.*, **71**, 127–8 (*Jan.* 15, 1947).—The energy levels of Mn^{56} associated with the (d, p) reaction appear to have an average spacing of about 0·85 MeV. W. E. D.

539.152.1 1263

On the scattering and absorption of particles by atomic nuclei. FESHBACH, H., PEASLEE, D. C., AND WEISSKOPF, V. F. *Phys. Rev.*, **71**, 145–58 (*Feb.* 1, 1947).—The resonance energies, particle widths and other characteristic features can be expressed in terms of the logarithmic derivation of the particle wave-function at the nuclear surface. Simple assumptions about the behaviour of the incident particle inside the nucleus are used to find approximate expressions for (1) the particle widths in terms of the level spacing; (2) the neutron scattering cross-section near and between resonances; (3) the total cross-section and the absorption cross-section averaged over neighbouring levels for neutron energies up to 1 MeV. These results are then compared with the experimental data and are found to be in qualitative agreement. A.

539.152.1 1264

Reaction and scattering cross-sections. WIGNER, E. P. *Proc. Nat. Acad. Sci., Wash.*, **32**, 302–6 (*Dec.*, 1946).—

By counting the number of free parameters in the unitary collision matrices, the circumstances in which the cross-sections may vanish are derived. A. P. F.

359.152.1 : 53.081.3 1265

Integral and rational numbers in the nuclear domain and their significance. WITMER, E. E. *Phys. Rev.*, **71**, 126 (*Jan.* 15, 1947).—Some integral relationships between fundamental constants are pointed out. A new unit of energy—the *prout*—is defined as 1/12 of the binding energy of the deuteron, and it is shown that the binding energies of nuclei can be expressed as integral multiple of prouts. Special significance is attached to the number 42 which appears in several of the relations listed. W. E. D.

539.152.1 : 537.591 1266

Possibility of "conditional" saturation in nuclei. FEENBERG, E., AND PRIMAKOFF, H. *Phys. Rev.*, **70**, 980–1 (*Dec.* 1 *and* 15, 1946).—Firstly, a microcrystal of 90 deuterium atoms is given as an example of "conditional" saturation, because if it were possible to cause it to collapse into a single atom ($Z = 90$, $A = 180$) there would be a large emission of energy. It is suggested that nuclear saturation may be of the conditional type, and that under certain conditions some nuclei (presumably the heavier ones) might collapse to the lower energy state. The implications of such a process are considered in connection with nuclear processes and cosmic rays. W. E. D.

539.152.1 : 539.185.7 *see Abstr.* 1317–19

539.152.2 1267

Nuclear magnetic resonance absorption in hydrogen gas. PURCELL, E. M., POUND, R. V., AND BLOEMBERGEN, N. *Phys. Rev.*, **70**, 986–7 (*Dec.* 1 *and* 15, 1946).—This absorption was examined at room temperature and at pressures ranging from 10 to 30 atmospheres. With a frequency of 29·1 Mc/s, a very sharp resonance line was observed at 0·25 gauss and was independent of the pressure. At 10 atmospheres the relaxation time was of the order of 10^{-2} sec. The method is to be applied to He^3. W. E. D.

539.152.2 : 548.7 1268

Resonance absorption by nuclear magnetic moments in a single crystal of CaF_2. PURCELL, E. M., BLOEMBERGEN, N., AND POUND, R. V. *Phys. Rev.*, **70**, 988 (*Dec.* 1 *and* 15, 1946).—A resonance absorption for the magnetic field, in the 001-crystal direction, was found at the fluorine resonance frequency of 29·1 Mc/s, with a width of 8·5 gauss compared with the theoretical value of 5·4 gauss. The spin-lattice relaxation time was of the order of 5 sec and independent of the crystal orientation. W. E. D.

539.152.2 : 535.343.4–14 : 535.337 1269

Determination of nuclear spin from the Stark effect of microwave rotational spectra. SMITH, W. V. *Phys. Rev.*, **71**, 126–7 (*Jan.* 15, 1947).—A suggested extension of recent observations [Abstr. 827 (1947)] is worked out.

539.155.2 1270

Abundance of He^3 in atmospheric and well helium ALDRICH, L. T., AND NIER, A. O. *Phys. Rev.*, **70**, 983–4 (*Dec.* 1 *and* 15, 1946).—The abundance ratio of He^4/He^3, measured with a mass spectrograph, was found to be 9×10^5 for atmospheric He and 7×10^6 for well He. W. E. D.

539.155.2 1271

Relative abundance of the copper isotopes and the suitability of the photometric method for detecting small variations in isotopic abundance. DUCKWORTH, H. E., AND HOGG, B. G. *Phys. Rev.*, **71**, 212 (*Feb.* 1, 1947).

539.155.2 : [533.15 + 537.363] = 3 1272

The phenomenological theory of two methods of isotope separation. KLEMM, A. *Z. Naturforsch*, **1**, 253–7 (*May*, 1946) *In German.*—The theory of isotope separation is given for the following cases: (1) At the plane $x = 0$, constant concentration is maintained of two isotopes which diffuse into a medium in the semi-space $x > 0$, the diffusion constants of the isotopes being D_j and D_k. In the space $x > x_1$ a mixture is obtained which has an average enrichment factor Q given approximately by $Q = f \log_e q$, where $q = D_j/D_k$ and $f = \log_e(\nu^0/\nu)$. Here ν^0 and ν are the amounts of isotope mixture that have diffused through the surfaces $x = 0$ and $x = x_1$ respectively. (2) A "moving boundary" is formed between two electrolytes, one of which has the two isotopes as cations and the other has a cation of lower mobility and the same anion as the first electrolyte. An electric current is passed so that the isotope ions travel in front of the other cations. If the transfer velocities w_j and w_k of the isotope ions are different, one obtains a separation factor Q given approximately by $\log_e Q = f \log_e q$ with $q = w_j/w_k$ and $f = 2w^0t/\sqrt{(\pi Dt)}$. Here w^0 is the average relative velocity between cations and anions, D the average diffusion constant and t the time. The enriched zone extends from the boundary to a distance of approximately $\sqrt{(\pi Dt)}$. H. L.

539.155.2 : 533.7 : 533.15 1273

The separation of isotopes by thermal diffusion. JONES, R. C., AND FURRY, W. H. *Rev. Mod. Phys.*, **18**, 151–224 (*April*, 1946).—The paper gives a general survey of the phenomenological theory of the functioning of separation columns, including continuous and non-continuous operation for both the plane and the cylindrical case which has been previously treated [Abstr. 2666 (1939), 2147 (1946)]. The theory has been simplified and brought into a form more convenient for practical application. The most important new contribution is the complete analysis of the principles of design of multi-stage apparatus. Numerical examples are given, and practical problems discussed. The paper includes a discussion of experimental literature and a comprehensive bibliography, up to 1945. H. L.

539.155.2 : 538.691 1274

A high intensity mass spectrograph for experiments on the separation of isotopes. KOCH, J., AND BENDT-NIELSEN, B. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **21** (*No.* 8) 28 *pp.* (1944).—Ions produced in a low-voltage arc source are accelerated through 80 kV max., focused by a system of electrostatic lenses, analysed by a 90° deflection of 80 cm mean radius between the poles of an electromagnet (max. field 8 000 oersteds), and collected by Faraday cylinders. The mass dispersion of the apparatus and the width of the lines of the mass spectrum are calculated and are close to the observed values. The resolving power $A/\Delta A > 238$ for an ion current of 10 μA at 50 kV. T. G. P.

539.155.2 : 541.123.5 = 3 1275

Enrichment of N^{15} in a two-stage exchange plant. BECKER, E. W., AND BAUMGÄRTEL, H. *Z. Naturforsch.*, **1**, 514–17 (*Sept.*, 1946) *In German.*—N^{15} was enriched from 0·38% to 18·2%, in a 2-stage chemical exchange column similar to one of Thode and Urey [Abstr. 477 (1939)], using the exchange reaction NH_4NO_3/NH_3. The column gives a continuous output of about 3 g/day NH_4Cl containing 10 to 12% N^{15}. H. L.

539.156 : 537.564 1276

The quantal calculation of the photo-ionization cross-section of atomic potassium. BATES, D. R. *Proc. Roy. Soc. A*, **188**, 350–7 (*Feb.* 11, 1947).—The cross-section is very sensitive to the type of wave-function used; if the non-separability of the wave-functions is taken into account, it is probable that the experimental results

Abstr. 2326 (1943)] may be explained, for the close cancellation of the major part of the matrix element involved in the transition gives rise to the abnormally small cross-section and the anomalous frequency variation. L. S. G.

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16.08 1277

A method for measuring half-lives. GRAVES, A. C., AND WALKER, R. L. *Phys. Rev.*, **71**, 1–3 (*Jan.* 1, 1947).—Foils irradiated for various times are counted with Geiger counters after a lapse of time adjusted to make the counting rates of the foils the same. Saturated activities of the foils will be different if an incorrect value of the decay constant has been assumed, and equations are given for obtaining a more correct value. A.

539.163 1278

Isotopic assignment of Cd and Ag activities. HELMHOLZ, L. C. *Phys. Rev.*, **70**, 982–3 (*Dec.* 1 *and* 15, 1946).—The 6·7 hr activity is assigned to Cd^{107}, the 158 day activity to Cd^{109}, the 93 keV isomer to Ag^{107} and the 47 keV isomer to Ag^{109}. W. E. D.

539.163 1279

Disintegration scheme of Na^{24}. COOK, C. S., JURNEY, E., AND LANGER, L. M. *Phys. Rev.*, **70**, 985–6 (*Dec.* 1 *and* 15, 1946).—See Abstr. 951 (1947). The present experiments indicate that the 2·76 MeV γ-ray is in cascade with another γ-ray without being able to be definite about the latter. W. E. D.

539.163 : 539.17 *see Abstr.* 1303

539.163 : 539.185 1280

On the spontaneous emission of neutrons from the uranium nucleus. CHATTERJEE, S. D. *Indian J. Phys.*, **19**, 11–16 (*Dec.*, 1945).—The emission was detected using a boron-lined ionization chamber filled with BF_3. It is suggested that spontaneous fission of U is the cause, and that 3 neutrons are emitted. A.

539.163.1 1281

The decay constant of RaC′. JACOBSEN, J. C., AND SIGURGEIRSSON, T. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **20** (*No.* 11) 12 *pp.* (1943).—A RaB source was mounted between two counters, only one of which admitted the α-particles from RaC′. The pulses from both counters were passed through delay circuits before entering a Rossi coincidence circuit. The coincidence counting rate was measured as a function of the delay of the RaC β-particle pulses relative to the RaC′ α-particle pulses. The measurement gave directly the decay curve of RaC′; the $\frac{1}{2}$-period was found to be $(1{\cdot}55 \pm 0{\cdot}05) \times 10^{-4}$ sec, in good agreement with Rotblat's result [Abstr. 26 (1941)]. A critical comparison of the two methods is given. A. P. F.

539.163.1 1282

Artificial activities produced in europium and holmium by slow neutron bombardment. INGHRAM, M. G., AND HAYDEN, R. J. *Phys. Rev.*, **71**, 130 (*Jan.* 15, 1947).—A 27·5 hr activity is ascribed to Ho^{166}. As well as the 9·2 hr activity of Eu^{152}, europium has two further activities with $\frac{1}{2}$-lives of the order of several years, one of which must be ascribed to mass 152 and the other to mass 154. W. E. D.

539.163.1 1283

Production and isotopic assignment of a 90 day activity in element 43. MOTTA, E. E., BOYD, G. E., AND BROSI, A. R. *Phys. Rev.*, **71**, 210–11 (*Feb.* 1, 1947).—The activity is assigned to 43^{97}, formed by *K*-capture decay of 3-day Ru^{97}, and possibly also by deuteron bombardment of Mo. W. E. D.

539.163.2 1284

β- and γ-ray energies of several radioactive isotopes. MILLER, L. C., AND CURTISS, L. F. *Phys. Rev.*, **70**, 983, (*Dec.* 1 *and* 15, 1946).

539.163.2 1285

Gamma rays of Po^{210}. DE BENEDETTI, S., AND KERNER, E. H. *Phys. Rev.*, **71**, 122 (*Jan.* 15, 1947).—This is a single component of energy 0·8 MeV. The only soft radiation is probably attributable to the *L* line of Po. W. E. D.

539.163.2 1286

Gamma rays from tungsten and molybdenum. SCHWARTZ, W. M., AND POOL, M. L. *Phys. Rev.*, **71**, 122–3 (*Jan.* 15, 1947).—The 24 h W isotope gave γ-rays of energies 480, 570, 690, 790 and 860 keV, and a possible energy level diagram for the resulting nucleus Re^{187} is given. The 67 h Mo gave three γ-rays of energies 770, 815 and 840 keV. W. E. D.

539.163.2 : 539.172 *see Abstr.* 1305

539.164.81 1287

Ionisation measurements on single recoil particles from Po, ThC, and ThC′. MADSEN, B. S. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 8) 16 *pp.* (1945).—Experiments to find the mean energy expended by recoil nuclei in producing an ion pair in argon are described. A cylindrical proportional counter was used to record the total ionization produced by the recoil particle. The gas amplification of the counter was first studied as a function of the position of the primary ionization track within it, and was found essentially constant throughout the central section, with a rapid decrease towards the ends. Thin preparations of Po and ThC + C′ were suitably mounted on the wall of the counter, so that the α-particles emerging within a small solid angle could enter a nearby Geiger counter. A coincidence circuit was used to record the pulse size in the proportional counter when an α-particle entered the Geiger counter. An auxiliary Po source was employed to establish the energy scale of the output pulses. The mean energy per ion pair was found to be 67 eV over the energy range 104 keV (Po recoil) to 170 keV (ThC′ recoil), assuming 25 eV for an α-particle. A. P. F.

539.165.2 1288

Theory of β-decay. ROZENTAL, S. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **18** (*No.* 7) 44 *pp.* (1941).—The meson theory of nuclear fields developed by Møller and Rosenfeld [Abstr. 740 (1947)] is applied to the calculation of β-decay. In expressing the Hamiltonian for the system in its most general relativistic form 4 universal constants appear as well as the f's and g's of the Møller–Rosenfeld theory. A general formula is developed for the energy distribution of β-particles in the case of allowed transitions in light nuclei, i.e. when $\alpha Z \ll 1$, α being the fine structure constant. This formula involves the universal constants, but it is shown that in the case of allowed transitions the expression reduces to one of two simple types and no further advantage is gained by assuming, with Møller [Abstr. 741 (1947)], simplifying relations between the constants. The value of the constants cannot be fixed until more precise experimental data is available. It is pointed out that the relationship between the constants, as assumed by Møller, would lead to the vector mesons and pseudoscalar mesons having the same $\frac{1}{2}$-life period. W. E. D.

539.165.2 1289

Theory of β-decay. II. ROZENTAL, S. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 11) 14 *pp.*

(1945).—The energy distribution of β-particles is calculated for nuclei for which the earlier restriction that $\alpha Z \ll 1$ does not hold. By using the relationships between the constants—f's and g's—suggested by Møller the number of disposable constants is considerably reduced. The final formula for the energy distribution contains a number of terms, the most important of which are either of the form of the Fermi or generalized Fermi distribution [Abstr. 2020 (1937)]; the other terms become more important for forbidden transitions. W. E. D.
539.165.2 1290

β-ray spectrum of K^{40} and theory of β-decay. Marshak, R. E. *Phys. Rev.*, **70**, 980 (*Dec.* 1 *and* 15, 1946).—A theoretical discussion of experimental measurements on the β-decay of K^{40} shows that a fourth forbidden transition at disintegration is required. W. E. D.
539.165.8 1291

Recoil of the nucleus in β-decay. Jacobsen, J. C., and Kofoed-Hansen, O. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 12) 34 *pp.* (1945).—Many of the difficulties encountered in the measurements on the energy of recoil of a β-disintegrating nucleus have been overcome by choosing a β-radioactive (Kr^{88}) which is a gas, and which transforms to a β-radioactive nucleus (Rb^{88}). The apparatus consists of a box with one side of gauze contained in a larger box. Radioactive Kr^{88} is admitted to the apparatus and the energy distribution of the recoil nuclei determined by retarding potentials applied between the gauze and outer box, the number of Kr^{88} nuclei reaching the outer electrode being determined by the number of active Rb^{88} nuclei deposited there. The maximum energy of recoil was found to be $51 \cdot 5 \pm 2$ eV and agrees, within experimental error, with the recoil energy expected from the maximum energy β-particles (2·4 MeV) with zero neutrino energy. The energy distribution of the recoil nuclei is inconsistent with the assumption of a β-emission only, and for reconciliation it is necessary to assume a third entity carries away some of the energy. W. E. D.
539.166.08 : 537.542 = 3 1292

The absolute sensitivity of gamma ray counters. Maier-Leibnitz, H. *Z. Naturforsch.*, **1**, 243–52 (*May*, 1946) *In German.*—An extensive survey is made of the sensitivity of various counters (brass, Al, Pb, Sn) to γ-rays of energies between 0·05 MeV and 3 MeV. The results of earlier experiments are evaluated and new measurements with cassiopeium (lutecium) and ytterbium are added. The results show that all counters are about equally sensitive for γ-ray energies >1 MeV, but <1 MeV marked differences appear. Pb counters have almost uniform sensitivity from 0·15 to 1·5 MeV. Al counters have a strong energy dependence. A 2-mm wall brass counter has a sensitivity proportional ($\pm 10\%$) to γ-ray energy between 0·1 and 3 MeV. Below 0·1 MeV a thin-walled (0·01 mm) Sn counter is the most efficient. A. P. F.
539.166.2 1293

Angular distribution of γ-rays in Na^{24}, Co^{60}, Y^{88}. Good, W. M. *Phys. Rev.*, **70**, 978–9 (*Dec.* 1 *and* 15, 1946).—The radioactive decay of these three nuclei is followed in each case by two successive γ-ray transitions. The angular distribution of the two γ-rays relative to one another was measured and no departure from an isotropic distribution was found. One suggestion advanced for the lack of asymmetry is the magnetic coupling between the nucleus and orbital electrons, but an attempt at decoupling with a field of 17 000 gauss had no effect. W. E. D.
539.166.2 = 5 1294

Angular distribution of γ-rays emitted by the reaction $^1H + {}^7Li = {}^8Be + \gamma$. Ageno, M., Amaldi, E., Bocciarelli, D., and Trabacchi, G. C. *Ric. Sci.*, **12**, 139–43 (*Feb.*, 1941) *In Italian.*—Using a triple coincidence counte arrangement, described in detail, emission and absorptio of γ-rays resulting from proton bombardment (500 kV) c Li were measured as function of the angle θ betwee direction of incident protons and observation. It concluded that the level $_4Be^{8*}$ is odd, and that th incident wave is an s-wave, total quantum = 1. J. A. W
539.167.3 129

Formation of radium E and polonium by deuteron bom bardment of bismuth. Tatel, H. E., and Cork, J. M *Phys. Rev.*, **71**, 159–64 (*Feb.* 1, 1947).—Present result indicate that as the deuteron energy is lowered fro 8·8 to 7·3 MeV, the production ratio of RaE/Po increase 25%, but more than doubles from 7·3 to 5·5 MeV. Th trend is in agreement with the Oppenheimer–Phillip reaction in which RaE is produced by a d, p reaction an Po is produced by a d, n reaction. Assuming thes reaction cross-sections to be respectively proportional t Bethe's OP penetration factor and to the Gamow Condon–Guerney penetration factor, best agreement i obtained with a nuclear radius of $2 \cdot 0A^{\frac{1}{3}} \times 10^{-13}$ cm for Bi. A
539.167.3 129

Long-life radio-iodine. Reid, A. F., and Keston, A. S *Phys. Rev.*, **70**, 987–8 (*Dec.* 1 *and* 15, 1946).—A new isotope with a $\frac{1}{2}$-life of about 56 days has been found b deuteron bombardment of Te. Possible methods o production are $Te^{128}(d,n)I^{129}$ or $Te^{128}(d,p)Te^{129}$, th Te^{129} transforming to I^{129} by β-decay. A further activit with a $\frac{1}{2}$-life >200 days separated out with Te. W. E. D
539.167.3 = 3 129

Isomers of stable nuclei by neutron capture by dys prosium and hafnium. Flammersfeld, A. *Z. Naturforsch.*, **1**, 190–6 (*April*, 1946) *In German.*—Irradiation o Dy_2O_3 with retarded (D + D) neutrons gave rise to a new activity of half-life 1·25 min. The energy of th emitted β-rays is only 130 keV. Consideration of th Sargent diagram shows that this is not a case of β disintegration, but an isomeric change. The excited Dy nucleus arises from the next lower Dy isotope by neutron capture. From the frequency of the Dy isotopes and the Mattauch rule for nuclear isomerism, the new activity is ascribed to Dy^{163*}. Bombardment of Hf with slow neutrons gives rise to a new activity of $\frac{1}{2}$-life 19 sec. This is again an example of an isomeric transition, completely analogous to the case of Dy, and the activity may be ascribed to $Hf^{177,179*}$. A. J. M
539.169 : 621.319.35 1298

Nuclear electrostatic generator. Linder, E. G. *Phys Rev.*, **71**, 129–30 (*Jan.* 15, 1947).—Eu^{154}, Cs^{134} and Co^{6} are suggested as suitable radioactive materials for this type of generator. [Abstr. 2664 (1946)]. W. E. D
539.17 129

On the effective charge of fission fragments. Lassen, N. O. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 2) 25 *pp.* (1945).—A line source of fission fragments was obtained from a narrow U layer mounted close to an internal Be target in the cyclotron. The fragments were deflected by the magnetic field of the cyclotron and entered a N-filled pulse ionization chamber after passing through two defining slits. The $H\rho$ distribution exhibits only one maximum, from which it is deduced that the heavier fragments carry the higher effective charge at the beginning of the range. The upper and lower limits of the effective charge are deduced to be 33 and 13 elementary charges, respectively. A. P. F.
539.17 1300

Pairs of fission fragments from U^{235}. Demers, P. *Phys. Rev.*, **70**, 974–5 (*Dec.* 1 *and* 15, 1946).—Tracks of

ion pairs were observed in photographic emulsion by ng a technique which enabled the position of the integrating nucleus to be fixed. Three layers were laid wn on the glass in the order: emulsion, uranium com- und, emulsion. In nearly all the cases examined the ir consisted of a long and a short track, the longer being ntified with the more energetic and lighter particle. occasional α-track also appeared to originate from the ne point as the pair and the time of its emission is shown be $<2\times10^{-14}$ sec after fission. W. E. D.

9.17 1301

Concentration of plutonium in pitchblende. CORVALEN, I. *Phys. Rev.*, **71**, 132 (*Jan.* 15, 1947).—The rate of oduction of Pu from U^{238} by the capture of neutrons itted by UX_2 [see Abstr. 1116 (1946)] is not sufficient account for the measured abundance of Pu in chblende. W. E. D.

9.17 1302

Angular distribution of the $Li^7(p, \alpha)\alpha$ reaction. RUBIN, FOWLER, W. A., AND LAURITSEN, C. C. *Phys. Rev.*, , 212–14 (*Feb.* 1, 1947).—Results agree with earlier rk [Abstr. 3206 (1940)] for protons up to 900 keV, t there is only a gradual decrease in asymmetry from 0 to 1 400 keV. W. E. D.

9.17 : 539.163 1303

Nuclei formed in fission: decay characteristics, fission lds, and chain relationships. *Rev. Mod. Phys.*, **18**, 3–44 (*Oct.*, 1946). *See also J. Amer. Chem. Soc.*, **68**, 11–42 (*Nov.*, 1946).—Two tables are presented, con- ining all data available up to June 1, 1946, with ferences to published and unpublished sources.

9.172 1304

Deuteron-induced fission of uranium and thorium. COBSEN, J. C., AND LASSEN, N. O. *K. Danske Vidensk. lsk. Mat.-fys. Medd.*, **19** (*No.* 6) 24 *pp.* (1941).— euteron bombardment of U and Th in the cyclotron oduced appreciable numbers of fissons for deuteron ergies between 8·0 and 9·5 MeV. The fission frag- ents were collected on foils and their β-activity was easured. A subsidiary experiment was performed to easure the β-activity per fission fragment. From this d the known integrated deuteron flux the cross-section r fission was evaluated to be ~ 0·02 barns at 9·0 MeV r both U and Th, agreeing fairly well both in absolute lue and in energy-dependence with the Bohr theory. eviations from the theoretical curve in the case of U ay be due to the isotope U^{235}. A. P. F.

9.172 : 539.163.2 1305

The radiations emitted by $^{239}_{92}U$, and its formation in e deuteron bombardment of uranium. FEATHER, N., AND RISHNAN, R. S. *Proc. Camb. Phil. Soc.*, **43**, 267–73 *April*, 1947).—Small quantities of U were bombarded ith 9 MeV deuterons (10 min, at 2 to 5 μA). The diations of $_{92}U^{239}$ produced in this process were amined by the absorption method. The normal mode disintegration involves β-particles with an upper ergy of 1·20 ± 0·02 MeV, and a low-energy γ-ray of 5 ± 3 keV. Evidence was found for electrons of less ergy, and more penetrating γ-rays of low intensity. uantum radiations corresponding to *L* X-rays were tected. The excitation function for the process $U^{238}(\alpha, p)_{92}U^{239}$ was studied. L. S. G.

9.172.13 1306

The disintegration of Li^7 by deuterons. BENNETT, W. E., ONNER, T. W., RICHARDS, H. T., AND WATT, B. E. *hys. Rev.*, **71**, 11–14 (*Jan.* 1, 1947).—A 4·9 MeV γ-ray as found, and resonances at 0·65, 1·02, and 1·35 MeV, rresponding to excited states of the intermediate nucleus (Be^9) at 17·14, 17·43, and 17·69 MeV. That at 1·35 MeV was found only for the formation of radio- active Li^8 accompanied by the emission of a proton. Apparently proton emission is permitted and neutron emission forbidden from the 17·69 MeV state. A.

539.172.13 1307

Nuclear excitation functions. II. $Al^{27}(d; p, \alpha)Na^{24}$. CLARKE, E. T. *Phys. Rev.*, **71**, 187–91 (*Feb.* 1, 1947).—Hitherto unknown in light elements, a new reaction involving the emission of a proton and an α-particle has been observed by bombarding Al with 14 MeV deuterons. By an analysis of its excitation function, it is shown that the activity is not generated by the well-known (n, α) reaction, but is the result of the multiple disintegration of the compound nucleus ($Al^{27} + d$). A.

539.172.3 1308

Photo-fission in heavy elements. BALDWIN, G. C., AND KLAIBER, G. S. *Phys. Rev.*, **71**, 3–10 (*Jan.* 1, 1947).—Measurements have been made of the yields of photo- fission in U and Th, using continuous X-rays from a 100 MeV betatron. Curves of fissions per roentgen unit were of similar shape, with max. at 18 MeV. The ratio of U and Th yields $\simeq 2$ at all X-ray energies. No fissions were observed of Bi, Pb, Tl, Au, W, and Sm. A rough analysis shows that the cross-section as a function of quantum energy passes through a max. $\sim 5\times10^{-26}$ cm² for U and then decreases, and is extremely small above 30 MeV. A.

539.172.3 1309

On the photo-disintegration of the deuteron. PAIS, A. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **20** (*No.* 17) 30 *pp.* (1943).—The properties of deuteron wave- functions are discussed and the effect of irradiation of a deuteron with a monochromatic polarized γ-ray beam is examined. Photo-disintegration (treated up to the first order in the velocities) and proton-neutron capture are examined from the point of view of the symmetrical M–R meson theory [Abstr. 740 (1947)]. Numerical calculations are carried out, using radial wave functions for the ground state and the ^1S state determined by Hulthén [Abstr. 48 (1943)]. L. S. G.

539.172.4 1310

Disintegration of boron by slow neutrons. BØGGILD, J. K. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **23** (*No.* 4) 26 *pp.* (1945).—Cloud chamber studies are described of the $B^{10}(n, \alpha)$ reaction with slow neutrons, using a chamber containing the vapour of boron ester. Tracks corresponding to the reaction were distinguished from proton recoils by the fact that the latter suffer marked deviations at one end only (when they have become slow). The analysis of disintegration track lengths was found to be free from background and exhibited two distinct groups (11·35 mm and 13·3 mm, in air at N.T.P.). The longer range, corresponding to a residual Li nucleus in the ground state, represents a total reaction energy of 2·82 MeV. The shorter group, comprising 93% of the disintegrations, is produced when the Li nucleus is left in an excited state, estimated from the difference of track lengths to be at 0·42 MeV. An incidental measurement on the slow neutron $N(n, p)$ reaction gave a *Q* of 0·60 MeV for this process. A. P. F.

539.172.4 = 3 1311

Activation of rare earths by thermal neutrons. I–II. BOTHE, W. *Z. Naturforsch.*, **1**, 173–89 (*April*, 1946) *In German.*—The decay constants, energy and intensity of radiations, activation cross-sections and mass allocations of active nuclei formed by bombarding the following elements are given:—Tm, Lu, Yb, Sc, Yt, La, Ce, Pr, Nd, Sm, Eu, Tb, Dy, Ho and Er. A. J. M.

539.172.4 = 5 1312

On the fission of thorium and protoactinium. AMALDI, A., BOCCIARELLI, D., AND TRABACCHI, G. C. *Ric. Sci.*, **12**, 134–8 (*Feb.*, 1941) *In Italian.*—A previous report on U-fission [*Ric. Sci.*, **11**, 302, 413 (1940)] is summarized. Using two identical ionization chambers, one with U_3O_8-covered, the other with ThO_2-covered electrode at 3·5 kV, impulses from bombardment with neutrons from D + Be and D + Li reactions were counted. From tabulated data, Th cross-section : U cross-section = 1·35 ± 0·08; and combining with previous results, Th cross-section obtained from D + Li neutrons : from D + Be neutrons = 1·9 ± 0·2. Theory (Bohr) gives 2. For Pa a silver electrode covered with H_2SO_4 solution was used. D + Be neutrons gave 1 impulse in 2–3 min, D + Li neutrons 2–3 impulses per min. J. A. W.

539.18 : 537.591 1313

Disintegration of negative mesons. CONVERSI, M., PANCINI, E., AND PICCIONI, O. *Phys. Rev.*, **71**, 209–10 (*Feb.* 1, 1947).—A table is given showing the relative number, measured experimentally, of positive and negative mesons disintegrating on their passage through Fe and C. In Fe, very few negative mesons produce decay electrons, indicating that there is a much greater chance of the negative meson being captured by the Fe nucleus. In C, both positive and negative mesons produce decay electrons, and in this case the capture cross-section for the negative particles ≪ in Fe. W. E. D.

539.185 1314

Measurements of the neutron-proton scattering cross section. SIMONS, L. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **17** (*No.* 7) 16 *pp.* (1940).—A resonance absorption method for finding the scattering mean free path of slow neutrons in water is described. Neutrons were obtained from Ra–Be sources embedded in paraffin, and the scatterer was a shallow tray of water. Detectors and filters of Ag and I were used. The value of the *n–p* scattering cross-section was found to be 14·8 barns. [Note: This is considerably lower than the now accepted value of about 20 barns. Part of the discrepancy is due to an erroneous obliquity correction.] A. P. F.

539.185 = 5 1315

On density measurements of thermal neutrons. CORINALDESI, E. *Nuovo Cim.*, **3**, 131–41 (*June*, 1946) *In Italian.*—The perturbation introduced by the detector in the distribution of neutrons has been calculated for plane infinite detectors, and for circular detectors of different radii. The results are given as families of curves relating neutrons absorbed by the detector to the time density. Another family shows the average density beyond the detector. A.

539.185 : 537.542 *see Abstr.* 1234

539.185 : 539.163 *see Abstr.* 1280

539.185.7 1316

On the scattering of fast neutrons by protons and deuterons. AGENO, M., AMALDI, E., BOCCIARELLI, D., AND TRABACCHI, G. C. *Phys. Rev.*, **71**, 20–31 (*Jan.* 1, 1947).—The cross-sections of the proton, deuteron, and the carbon nucleus have been determined for 4·1, 12·5, and 13·5 MeV neutrons by detecting the corresponding recoil protons, and for 14 MeV neutrons by detecting by the 9·9 min activity induced in $_{29}Cu^{63}$. The *n–2n* disintegration of the deuteron has been investigated for 14 MeV neutrons and cross-section found. A.

539.185.7 : 539.152.1 1317

Slow neutron velocity spectrometer studies. I. Cd, Ag, Sb, Ir, Mn. RAINWATER, L. J., HAVENS, W. W., JR., WU, C. S., AND DUNNING, J. R. *Phys. Rev.*, **71**, 65–79 (*Jan.* 15, 1947).—The spectrometer [Abstr. 3204-(1946)] has been enlarged to permit 32 separate measur ments to be made simultaneously with improved precisio Results for resonance levels and cross-sections are give for the above elements. The cross-section of Cd agre excellently with the Breit–Wigner one-level formula ov a range of 100 : 1 in energy and 1 000 : 1 in cros section.

539.185.7 : 539.152.1 131

Slow neutron velocity spectrometer studies. II. A In, Ta, W, Pt, Zr. HAVENS, W. W., JR., WU, C. S RAINWATER, L. J., AND MEAKER, C. L. *Phys. Rev.*, **7** 165–73 (*Feb.* 1, 1947).

539.185.7 : 539.152.1 131

Slow neutron velocity spectrometer studies. III. I, O Co, Tl, Cb, Ge. WU, C. S., RAINWATER, L. J., AN HAVENS, W. W., Jr. *Phys. Rev.*, **71**, 174–81 (*Feb.* 1947).

STRUCTURE OF SOLIDS 539.2

539.216 : 532.63 132

Dimensional changes accompanying capillary con densation. HIRST, W. *Nature, Lond.*, **159**, 267–8 (*Feb.* 22 1947).—The effect of the pressure of mobile adsorbe films, neglected by Banks and Barkas [Abstr. 294 (1946)], is pointed out.

539.23 132

An electron diffraction study of the structure of thi films of normal paraffins. BRUMMAGE, K. G. *Proc. Roy Soc. A*, **188**, 414–26 (*Feb.* 11, 1947).—Films of $C_{24}H_{50}$ $C_{30}H_{62}$ and $C_{34}H_{70}$ deposited on stainless steel, coppe or collodion were examined by both the reflection an transmission techniques. The films on steel and coppe were heated, and curves derived relating the temperatur at which the ordered film structure breaks down, to th film thickness. L. S. G.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.4

539.37 132

The theory of wedge indentation of ductile materials HILL, R., LEE, E. H., AND TUPPER, S. J. *Proc. Roy. Soc A*, **188**, 273–89 (*Jan.* 30, 1947).—A rigid frictionles wedge penetrates a plastic material. The form of th lip and the deformation in the material squeezed ou towards the surface is determined theoretically, and th variation with wedge angle of the force required fo penetration is found in terms of the yield stress in a tensile stress. The theory is compared with experiment in which lead blocks are indented by steel wedges coate with vaseline, and it predicts satisfactorily the deforma tion of a grid of squares ruled on a cross-section of th block. L. S. G.

539.4.015 : 678 1323

Erratum: Theory of filler reinforcement. DEWEY, J. M. *J. Appl. Phys.*, **18**, 132 (*Jan.*, 1947).—See Abstr 2009 (1945).

539.4.016 1324

On the mechanical behaviour of metals in the strain-hardening range. HANDELMAN, G. H., LIN, C. C., AND PRAGER, W. *Quart. Appl. Math.*, **4**, 397–407 (*Jan.*, 1947).—An analysis is made of general states of stress and strain which may be reached by a single loading followed by at most one complete or partial unloading. There is a sharp distinction between differential and finite stress-strain relations and the assumption of the

ter is incompatible with certain postulates about the echanical behaviour under those stress changes which nstitute neither loading nor unloading. L. S. G.

9.4.016.2 1325

A note on the theory of dislocation in metals. DEAN, . R., AND WILSON, A. H. *Proc. Camb. Phil. Soc.*, **43**, 5–12 (*April*, 1947).—Simple closed formulae for the splacement and stress in the dislocation are given, and ese allow Bragg's recent assumptions regarding work-rdening in metals to be discussed quantitatively. In e dislocation considered the medium is bounded ternally by two long circular cylinders. The energy of ain of the dislocation is calculated and the energy strain per unit volume is estimated. The latter is mpared with experimental values of the energy of ld-work of copper [Abstr. 456 (1934)]. L. S. G.

9.414 : 531.225 *see Abstr.* 1134

39.42 1326

Fragmentation of shell cases. MOTT, N. F. *Proc. Roy. oc. A*, **189**, 300–8 (*May* 1, 1947).—A theory is given the break-up of the metal case of a cylindrical ring-mb, in which the lines of fracture perpendicular to the is of the bomb are predetermined. From the theory a expression is given for the length of the average agment; this is shown to depend, if certain hypotheses e made, on the radius and velocity of the case at the oment of break-up, and on the mechanical properties the metal. A.

39.42 1327

Spiral cracks in glass tubes. NORZI, L. *Nature, ond.*, **159**, 306–7 (*March* 1, 1947).—An explanation is fered, on the assumption that Pyrex possesses small herical cavities, distributed at random, and deformed heating into ellipsoids.

39.42 : 621.179.152 : 669.71 = 3 1328

X-ray investigation of lattice disturbances due to rious causes and mechanisms of fracture in aluminium oys. ROHNER, F. *Schweiz. Arch. angew. Wiss. Tech.*, 3, 14–21 (*Jan.*, 1947) *In German.*—The intensity of the sturbances gives valuable information upon the stinction between fractures due to static load and namic fatigue. A.

39.431 : 541.135 1329

The mechanism of corrosion fatigue of mild steel. VANS, U. R., AND TCHORABDJI SIMNAD, M. *Proc. Roy. oc. A*, **188**, 372–92 (*Feb.* 11, 1947).—The mechanism as established by means of chemical and electrochemical easurements. These are fully described. One aim as to prevent corrosion fatigue by means of cathodic rrents. Such a current diminishes the rate of pro-uction of iron compounds. Weak currents shorten the fe but stronger currents increase it. This is explained. the current reaches a certain value corrosion cannot detected, and the life becomes extremely long in eutral KCl. L. S. G.

39.434 1330

Dislocation theory as applied by N.A.C.A. to the creep f metals. NOWICK, A. S., AND MACHLIN, E. S. *J. Appl. hys.*, **18**, 79–87 (*Jan.*, 1947).—An equation for the eady-state rate of creep of pure annealed polycrystalline etals is derived through dislocation theory and the eory of rate processes. The rate of generation of islocations is the rate-determining process. A specific echanism for the generation of a dislocation is resented, from which the heat and entropy of activation f the process are expressed in terms of physical constants f the material. The lowering under stress of the potential energy barrier, which yields the stress-dependent term, is given in terms of constants of the material and a "back-stress" term. The creep equation obtained agrees well with published results. A.

539.434 1331

Creep deflections in columns. MARIN, J. *J. Appl. Phys.*, **18**, 103–9 (*Jan.*, 1947).—A rational theory is given for predicting the deflections. The theory is used to interpret tests on an Al alloy. A.

539.434 : 548.7 *see Abstr.* 1356

539.501 1332

A continuum theory of rheological phenomena. WEISSENBERG, K. *Nature, Lond.*, **159**, 310–11 (*March* 1, 1947).—Liquids are classified as *general* if a finite proportion of the strain existing in an energized state caused by the application of mechanical forces is recoverable after the release of these forces, and *special* if it is zero. Experimental tests to investigate these properties are briefly described and an extension of an earlier theory [Abstr. 2847 (1935)] is applied in outline to explain them.

539.501 : 620.17 : 621.315.616 1333

Apparatus for the study of the rheological properties of dielectrics. LETHERSICH, W. *J. Sci. Instrum*, **24**, 66–71 (*March*, 1947).—An apparatus is described which will measure the compressive strain on specimens 3 cm long and 1·3 cm dia. Strains up to 0·12 can be measured to an accuracy of 10^{-5}, and the apparatus can be used without modification for tensile tests. The lateral strain can be determined at the same time and to a similar order of accuracy. The shear properties are measured on thin-walled cylinders of material and an apparatus has been constructed for applying the shear stress and measuring the shear strain. This apparatus is particularly suitable for studying relaxation phenomena, since there is no friction after the stress has been removed. A.

539.61 1334

The physics of adhesion. DE BRUYNE, N. A. *J. Sci. Instrum.*, **24**, 29–35 (*Feb.*, 1947).—In a comprehensive review of the subject of adhesion the author shows how adhesion resolves itself into a study of the molecular forces at the interface between adherend and adhesive, and of the macroscopic strains in the joint. Wetting of the adherend by the adhesive is the governing factor. This is discussed from the point of view of both parties to the union, and of the types of molecular forces which produce this wetting. The function and mode of action of an oxide layer in glass-to-metal seals is indicated, and also the significance of polar and non-polar substances. In a consideration of the deformation and flow in joints, it is shown how residual strains arise, with particular reference to the bonding of wood with resins, and the strength of lap and scarf joints. A good bibliography is included. G. O. B.

539.621 : 541.126 1335

Hot spots on rubbing surfaces and the detonation of explosives by friction. BOWDEN, F. P., STONE, M. A., AND TUDOR, G. K. *Proc. Roy. Soc. A*, **188**, 329–49 (*Feb.* 11, 1947).—The hot spots become visible at a temperature of about 520–570°C, and may occur on glass or quartz when the load is about 1 000 g and the sliding speed as low as 1 or 2 ft/sec. The local surface temperatures are important in the chemical decomposition which accompanies the rubbing of solids. The detonation of a liquid explosive by friction is due to the development of local high temperatures on the surface of the sliding solids. Nitroglycerine explodes when the temperature of the hot spots is about 480°C. L. S. G.

PHYSICAL CHEMISTRY 541

CHEMICAL EQUILIBRIUM 541.121/.123

541.123.5 : 539.155.2 *see Abstr.* 1275

REACTION KINETICS 541.124/.128

541.124 : 548.7 *see Abstr.* 1357

541.126 1336

The period of impact, the time of initiation and the rate of growth of the explosion of nitroglycerine. BOWDEN, F. P., MULCAHY, M. F. R., VINES, R. G., AND YOFFE, A. *Proc. Roy. Soc. A*, **188**, 311–29 (*Feb.* 11, 1947).—The period of impact was measured by an electrical and a photographic method and was found to be about 200 μsec. An attempt was made to determine at what stage of the impact initiation of the explosion occurs, and to follow the course of the explosive reaction as it grows from the point of initiation at the tiny hot bubble, spreads through the liquid film and develops into a large-scale detonation. Cavity impact and the impact of flat surfaces on strips and droplets of the explosive were investigated. L. S. G.

541.126 1337

The detonation of liquid explosives by gentle impact. The effect of minute gas spaces. BOWDEN, F. P., MULCAHY, M. F. R., VINES, R. G., AND YOFFE, A. *Proc. Roy. Soc. A*, **188**, 291–311 (*Feb.* 11, 1947).—An amplification of previous report [Abstr. 1137 (1946)]. The sensitivity of liquid explosives is greatly affected by the shape of the impacting surfaces. This is examined fully. The explosion of nitroglycerine, and some other substances, is investigated. L. S. G.

541.126 : 534.222.2 1338

A theory of the dependence of the rate of detonation of solid explosives on the diameter of the charge. JONES, H. *Proc. Roy. Soc. A*, **189**, 415–26 (*May* 1, 1947).—The velocity is shown to be dependent on the diameter of the charge. It is shown that the relation between the velocity of a detonation wave, in a cylindrical charge of solid explosive, and the diameter depends upon the rate of the chemical reaction occurring in the front portions of the wave, and that this rate of reaction can be determined by measuring the velocity in bare charges of different diameters. The effect of a metal case surrounding the charge is also briefly discussed. A.

541.126 : 539.621 *see Abstr.* 1335

541.127.4 : 539.132 : 534.222.2 *see Abstr.* 1162

ELECTROCHEMISTRY 541.13

541.133 1339

The electric conductivity and the activation energy of ionic migration of molten salts and their mixtures. BLOOM, H., AND HEYMANN, E. *Proc. Roy. Soc. A*, **188**, 392–414 (*Feb.* 11, 1947).—The conductivity (κ) varies with temperature (t) thus: $\kappa \propto \exp(-C/Rt)$ where C is the activation energy. The values of κ for a number of mixtures of electrolytes were measured over a range of compositions and temperatures. L. S. G.

541.135 : 539.431 *see Abstr.* 1329

541.135.5 = 3 1340

Resistance and capacity at the interfaces of electrochemical electrodes. FALK, G., AND LANGE, E. *Z. Naturforsch.*, **1**, 388–92 (*July*, 1946) *In German.*—The boundary layer between metal and electrolyte produces a resistance polarization which is now investigated both theoretically and experimentally. The production of the ohm potential gradient is bound up with charge, and consequently with appreciable changes with time; with h.f. currents the effect appears as a resistance. Measurements of the systems Cu/Cu-ion solution and Pb/4 M H_2SO_4 afforded resistances of 1·5 to 5·5 Ω cm^2. The theoretical and practical significance of the unexpected size of the resistance is discussed. H. H. HO.

COLLOIDS . DISPERSE SYSTEMS 541.18/.182

541.18 : 537.363 *see Abstr.* 1220

541.182.3 : 621.359.4 : 621.317.39 1341

An investigation of a method for the analysis of smokes according to particle size. LIPSCOMB, W. N., RUBIN, T. R., AND STURDIVANT, J. H. *J. Appl. Phys.*, **18**, 72–9 (*Jan.*, 1947).—A thin stream of smoke particles moving under laminar conditions in a wind tunnel is electrically charged in a small region. The charged particles are then precipitated by the uniform field existing between the charged upper plate and the earthed lower plate of the wind tunnel as a long track along the lower plate. The size-frequency distributions of the particles were determined from enlargements of electron-microscope photographs of samples of the smoke. The agreement between theory and experiment is fair. A.

ADSORPTION 541.183

541.183 1342

Length changes of activated carbon rods caused by adsorption of vapors. HAINES, R. S., AND MCINTOSH, R. *J. Chem. Phys.*, **15**, 28–38 (*Jan.*, 1947).—The length variations of two Zn chloride activated carbon rods caused by the adsorption of several vapours are reported. The relationship between % extension of the rod and calculated spreading pressure of the adsorbed film [Abstr. 4768–9 (1934)] agrees well with experiment for organic vapours above $\sim\frac{1}{3}$ saturation of the monolayer capacity, but not in the low adsorption region nor along the desorption branch of the water isotherm. A marked contraction of the rod below its original length was noted when water was desorbed, and this contraction may be considered as a proof of the establishment of concave menisci in the capillaries along the desorption branch. A.

541.183 : 536.658 1343

The heat of adsorption of diatomic molecules. MILLER, A. R. *Proc. Camb. Phil. Soc.*, **43**, 323–9 (*April*, 1947).—The heat of adsorption is calculated in the case of molecules which upon adsorption occupy two closest-neighbour sites. The values are compared with experimental values for H on a W surface. L. S. G.

541.183 : 621.315.56 : 537.311.32 *see Abstr.* 1214

541.183.3.08 : 532.61.08 *see Abstr.* 1146

541.183.5 : 536.42 1344

Surfaces of solids. XIV. A unitary thermodynamic theory of the adsorption of vapours on solids and of insoluble films on liquid subphases. JURA, G., AND HARKINS, W. D. *J. Amer. Chem. Soc.*, **68**, 1941–52 (*Oct.* 1946).—Evidence has been assembled showing that films on the surfaces of solids, which are monomolecular at low and polymolecular at high vapour pressures, exhibit phases which are analogous to those of insoluble films on water, and that the transitions between the phases are practically the same on both. Oil is used as a typical insoluble film on water. Equations of state, representing specific phase behaviour, valid for either oil monolayers on water or adsorbed films on solids have been derived

their validity discussed. The use of statistical hanics may improve the treatment; a correlation with Brunauer, Emmett and Teller theory has been n. W. R. A.

.183.54 : 537.361 *see Abstr.* 1219

CHEMICAL STRUCTURE 541.4/.6

.57 : 536.413 : 548.736 *see Abstr.* 1365

.57 : 537.561 1345

nisation potentials and bond order. WALSH, A. D. *ns. Faraday Soc.*, **42**, 779–89 (*Dec.*, 1946).—A possible nition of bond order in terms of ionization potentials uggested. Examples of its utility in converting one d quantity into another are given; in particular, bond er as here defined is approximately proportional to the e constant of the bond. This proportionality relation riefly considered in relation to various potential tions for diatomic molecules. Graphs are plotted by ch data on CC ionization potentials, bond lengths, e constants and bond energies may be inter-converted. A.

541.57 : 539.133 1346

Relations between carbon–carbon bond energy, order, and interatomic distance. KAVANAU, J. L. *J. Chem. Phys.*, **15**, 77–8 (*Jan.*, 1947).

CHEMICAL PROCESSES 542.9

542.921.4 : 535.338.4 *see Abstr.* 1178

CHEMICAL ANALYSIS 543/545

543.7 1347

The transuranium elements. SEABORG, G. T. *Science*, **104**, 379–85 (*Oct.* 25, 1946).—A review in which methods of isolation of the elements of atomic numbers 93, 94, 95 and 96 are described. The chemical properties of these elements as members of an actinide series are discussed. A. J. M.

545.822 1348

Use of incompletely consumed samples to illustrate effect of fractional distillation in carbon arc spectrochemical analyses. STROCK, L. W., AND HEGGEN, G. E. *J. Opt. Soc. Amer.*, **37**, 29–37 (*Jan.*, 1947).

CRYSTALLOGRAPHY 548

.0 : 537.529 *see Abstr.* 1227

.0 : 538.2 *see Abstr.* 1251

.522 1349

he formation of two-dimensional nuclei by ionic mole-s. DE BOER, J. H. *Proc. K. Ned. Akad. Wet.*, **49**, 3–10 (*Dec.*, 1946).—Ionic molecules condensing on a face in vacuo form nuclei one atom thick. Energy culations in the case of NaCl show that for more than e molecules these 2-dimensional nuclei are metastable respect to 3-dimensional, but the activation energy the transformation is about $7kT$ at room temperature. crystals thus tend to be lamellar. A. J. C. W.

.572 : 549.623.5 : 535.515 : 535.417 *see Abstr.* 1192

.7 1350

ynamics of the RbI crystal. HOFFMANN, T. A. *s. Rev.*, **70**, 981–2 (*Dec.* 1 *and* 15, 1946).—Jensen's culations [Abstr. 4030 (1936)] on the alkali halide ic crystals have been extended using the Gombás del [Abstr. 380 (1946)] and results for the lattice nstant, compressibility and infra-red wavelength are ained in good agreement with experiment. W. E. D.

.7 1351

New concepts of crystal structure. RAMAN, C. V. *rr. Sci.*, **15**, 329–31 (*Dec.*, 1946).—It is suggested that atoms in a crystal are located at the points of a mitive lattice, not all lattice points being occupied. usual unit cell is then an integral multiple of the mitive cell and the valence directions obey the law of tional indices. Some probable objections to the gestion are anticipated. A. J. C. W.

.7 1352

Derivative crystal structures. BUERGER, M. J. *J. Chem. ys.*, **15**, 1–16 (*Jan.*, 1947).—There exists a class of stal structures which are derived from others by neralization, and designated *derivative structures*, of ich a special case is the popular "superstructure." e symmetry of a derivative structure is a subgroup of symmetry of the basic structure. Here the term bgroup" is used in a wider sense than common in mathematical crystallography, and includes subgroups with multiple cells. The methods of finding the derivative symmetries are discussed. There are two important kinds of derivative structures, designated *substitution structures* and *distortion structures*. Substitution structures result when a set of different atoms is substituted for a set of like atoms in the basic structure. A.

548.7 : 535.375.54 1353

The theory of the Raman effect in crystals, in particular rock-salt. BORN, M., AND BRADBURN, M. *Proc. Roy. Soc. A*, **188**, 161–78 (*Jan.* 30, 1947).—The general theory for any crystal is developed by regarding the crystal as a large molecule and applying Dirac's theory of the interaction between particles and radiation. The Raman effect consists of contributions of different orders with respect to the amplitude of the vibrations. The 1st order effect is a line spectrum and the 2nd order effect is a continuous spectrum. The former is zero in highly symmetrical crystals such as rock-salt, and the latter, for rock-salt, consists of 36 peaks each belonging to a combination frequency. It was calculated with the help of Kellermann's tables of the lattice frequencies [Abstr. 1978 (1940)]. Various features of the 2nd order effect, e.g. frequency of observable maxima and relative intensities of the most prominent peaks, agree fairly well with experiment [Abstr. 1886 (1944)], and the results show that lattice dynamics can account for the Raman effect in crystals and that Raman's attacks against the theory are unjustified. L. S. G.

548.7 : 537.531 : 535.43 1354

Thermal scattering of X-rays by crystals. I. Dynamical foundation. BEGBIE, G. H., AND BORN, M. *Proc. Roy. Soc. A*, **188**, 179–88 (*Jan.* 30, 1947).—The scattering power of a crystal is expressed in terms of the dynamical matrix, M, of the lattice, which is the system of coefficients of the potential energy for small displacements of the particles. The elastic constants and other observable quantities may be calculated in terms of the elements of M, and the general theory of these calculations is developed. No assumption about the nature of the atomic forces is made. The method for reducing M with the help of the space group of the lattice is given. L. S. G.

548.7 : 537.531 : 535.43 1355

Thermal scattering of X-rays by crystals. II. The thermal scattering of the face-centred cubic and the close-packed hexagonal lattices. BEGBIE, G. H. *Proc. Roy. Soc. A*, **188**, 189–208 (*Jan.* 30, 1947).—The results of I [Abstr. 1354 (1947)] are applied to 2 special lattices, in each case assuming that only next-neighbour atoms act on one another. For the cubic lattice the dynamical matrix is expressed in terms of the elastic constants; numerical results are obtained by using the constants for KCl, and these are compared with the results of Iona [Abstr. 902 (1942)]. The scattering matrix is calculated and a diagram of equi-diffusion lines is drawn. For the hexagonal lattice the dynamical matrix is given in terms of the atomic constants. L. S. G.

548.7 : 539.11 *see Abstr.* 1257

548.7 : 539.152.2 *see Abstr.* 1268

548.7 : 539.434 1356

Stress induced preferential orientation of pairs of solute atoms in metallic solid solution. ZENER, C. *Phys. Rev.*, **71**, 34–8 (*Jan.* 1, 1947).—In a non-stressed cubic crystal the axes of pairs of adjacent solute atoms are randomly orientated along the several permissible crystallographic directions. It is shown that in the presence of a stress the equilibrium orientation is no longer random, but certain directions become preferred, and that the continual striving of the crystal to maintain equilibrium causes it to manifest all the characteristic anelastic effects, stress relaxation, internal friction, etc. In particular, its internal friction will be anomalously high in that temperature range where the time of relaxation for the establishment of equilibrium is comparable with the period of oscillation. A.

548.7 : 541.124 1357

Various types of disturbances in crystal lattices and their influence on chemical reactions and surface activity. HEDVALL, J. A. *Trans. Chalmers Univ. Tech., Gothenberg* (*No.* 4) 25 *pp.* (1942).—Certain crystals (AgI, Cu_2O) in their normal state possess defects (interstitial atoms, vacant lattice sites) that make ionic migration possible. In such cases rates of reaction, such as that of $HgI_2 + 2AgI = Ag_2HgI_4$, can be calculated from the electrical conductivity and the transference numbers of the ions. In substances that do not possess such defects as normal parts of their structure, reaction rates bear no relation to the electrical conductivity, but are very sensitive to non-equilibrium defects due to the method of preparation, etc. Thus in the temperature range 600°–900°C CaO reacts more rapidly with Fe_2O_3 prepared from the sulphate than with that from the oxalate. Spontaneous polarization has a considerable effect on surface reactions; the catalytic effect of Ni in a wide variety of reactions changes, and the rate of solution of Rochelle salt drops, on heating above their Curie points. Radiation reduces the amount of phenolphthalein adsorbed on CdS, and increases the decomposition of certain faces only of CdI_2 crystals by water vapour. There are numerous references. A. J. C. W.

548.73 1358

A method for the determination of crystal cuts by applying the reflection of X-rays from a known lattice plane. PETRŽÍLKA, V., AND BENEŠ, J. *Phil. Mag.*, **37**, 399–410 (*June*, 1946).—The method involves the measurement of two angles, formed by the cut plane and the known lattice plane or the crystallographic axis of the crystal formed by the cut plate. The problem arises in the manufacture of piezo-electric oscillators and resonators. The advantage of the method is that only a single placing of the plate in the spectrograph and a single exposure a necessary. L. S.

548.73 = 6 13

Graphical methods for the interpretation of Weissenbe photographs. AMOROS, J. L., AND FABREGAT, F. *Euclides*, **6**, 490–501 (*Sept.*, 1946) *In Spanish.*—A re procal lattice plane may be constructed by the use (*a*) a chart giving the Bragg angle and the azimuth of t crystal directly from the photograph, and (*b*) a cha mapping reciprocal space in terms of these variable The more usual method of curves of constant h and constant k is also described. A. J. C. W.

548.73 : 535.37 *see Abstr.* 1185

548.73 : 535.661.3 *see Abstr.* 1201

548.734.3 13

The preparation of filings for Debye–Scherrer diffracti photographs. HUME-ROTHERY, W. *J. Sci. Instrum.*, 2 75–6 (*March*, 1947).

548.736 13

The crystal structure of $(NH_4)_2[FeCl_5H_2O]$. LIN QVIST, I. *Ark. Kemi Min. Geol.*, **24 A** (*Paper* 1) 11 *p* (1946).

548.736 136

The crystal structure of the dioxides of molybdenum an tungsten. MAGNÉLI, A. *Ark. Kemi Min. Geol.*, **24** (*Paper* 2) 11 *pp.* (1946).

548.736 136

The crystal structure of magnesium tungstate. DUN NING, N. J., AND MEGAW, H. D. *Trans. Faraday Soc* **42**, 705–8 (*Dec.*, 1946).—Four structures formed at firin temperatures of roughly 300°C, 600°C, 1 000°C an 1 250°C respectively were found by the X-ray powde method. The first two cover a range of solid solution o either side of the composition $MgO.WO_3$. The thir is the monoclinic structure already known, of com position $MgO.WO_3$. The fourth may be either th 1 : 1 compound, or have a composition richer in WO_3. A

548.736 = 3 136

The crystal structure of LiMgN, LiZnN, Li_3AlN_2 an Li_3GaN_2. HUND, F. *Naturwissenschaften*, **33**, 121– (*Aug.* 30, 1946) *In German.*

548.736 : 536.413 : 541.57 136

Structure and thermal properties associated with som hydrogen bonds in crystals. VII. Behaviour of KH_2PO and KH_2AsO_4 on cooling. UBBELOHDE, A. R., AN WOODWARD, I. *Proc. Roy. Soc. A*, **188**, 358–71 (*Feb.* 1 1947).—A low-temperature micro-thermostat suitabl for single-crystal X-ray work is described. Therma expansions were measured by X-ray methods from roon temperature to 80°K. Hybrid crystal formation ac companying the thermal changes at the Curie points wa also measured, and information was obtained about th nature of subcrystalline units in hybrid crystals and thei merging into a single crystal above the transition point. L. S. G

548.737 136

Electron density map of anthraquinone crystal. SEN S. N. *Indian J. Phys.*, **19**, 243–6 (*Dec.*, 1945).

MINERALOGY 549

549.212 : 539.11 : 537.311.32 *see Abstr.* 1213

549.623.5 : 548.572 : 535.515 : 535.417 *see Abstr.* 1192

GEOPHYSICS 55

0.341 = 5 1367

Seismic records in Rome 1 Sept.–31 Dec. 1939. CALOI, PANNOCHIA, G., AND ROSINI, E. *Ric. Sci.*, **12**, 212–43 (*b.*, 1941) *In Italian.*—Dates, phases and characteristics tabulated. J. A. W.

0.1 = 3 1368

The homogeneity of the earth's interior. KUHN, W. *perientia*, **2** (*No.* 10) 391–7 (1946) *In German.*—The continuity revealed by transmission of earthquake ves is not due to a discontinuity in composition, to an iron core, but to a continuous decrease in cosity and relaxation time. When the latter reaches critical value transverse waves will no longer be opagated. It is suggested that the centre of the earth nsists of a solution of iron and gases, the physical nditions not allowing the iron to segregate. W. A. R.

1.46.018 : 621.317.39 1369

The measurement of sea-water velocities by electro-gnetic induction. GUELKE, R. W., AND SCHOUTE-NNECK, C. A. *J. Instn Elect. Engrs, Pt II*, **94**, 71–5 (*b.*, 1947).—[Abstr. 1167 B (1947)].

1.468 : 778.35 : 526.918.52 1370

The determination of the depths and extinction coefficients shallow water by air photography using colour filters. OORE, J. G. *Philos. Trans.*, **240**, 163–217 (*Jan.* 21, 47).—A sandy beach is photographed from the air rough a colour filter. The apparent brightness depends the depth of the water over the beach and on the tinction coefficient. If the latter is known, the water pth is determined by measuring the relative bright-ss at different points of a single photograph. If it is ot known, the measurements are made on a pair of notographs taken simultaneously through 2 special ters. A relationship between the extinction coefficients assumed and the depths are then calculated, either aphically or by a special calculator. The method is died theoretically, and experimental details for taking e photographs are described. Results obtained tween Sept. 1944 and Oct. 1945 are analysed. L. S. G.

METEOROLOGY 551.5

51.510.535 : 537.564 : 523.53 1371

Ionization by meteoric bombardment. PIERCE, J. A. *ys. Rev.*, **71**, 88–92 (*Jan.* 15, 1947).—The meteor shower Oct. 9–10, 1946, produced intense ionization in the per atmosphere. This phenomenon provides the first portunity to calculate directly the energy required to oduce an ionospheric layer. The necessary power is und to be a few W/km², a value comfortably exceeded the blackbody radiation of the sun in the region 1 000 Å. A.

51.547 1372

Pressure and temperature measurements in the upper mosphere. BEST, N. R., DURAND, E., GALE, D. I., AND AVENS, R. J. *Phys. Rev.*, **70**, 985 (*Dec.* 1 *and* 15, 1946).—tmospheric pressures recorded up to a height of 90 km ith apparatus placed in a V2 rocket are reported. The mperature measurements will be reported later. W. E. D.

51.554 : 533.6 1373

The aerodynamic drag of the earth's surface and the lue of von Karman's constant in the lower atmosphere. SHEPPARD, P. A. *Proc. Roy. Soc. A*, **188**, 208–22 (*Jan.* 30, 1947).—The drag was measured by observing the deflection of a horizontal plate, floating in oil and under torsional control, and forming part of the earth's surface. Measurements of the velocity profile above the surface enabled von Karman's constant to be estimated as 0·46, but the constant varies considerably with atmospheric stability. The variation of mixing length with height was also determined from the observations of drag and velocity profile. L. S. G.

551.574.7 : 536.421.4 1374

The production of ice crystals in a cloud of supercooled water droplets. SCHAEFER, V. J. *Science*, **104**, 407–8 (*Nov.* 15, 1946).—An investigation of some of the basic problems related to the icing of aircraft and other cold-weather phenomena was made by a study of ice crystals and "ice nuclei." With temperatures down to −20°C a supercooled cloud does not change to a crystalline structure by the introduction of many types of fine dust. The introduction of a piece of solid CO_2 caused the change in less than 10 sec, while a rod cooled in liquid air or at a temperature of −35°C in a cloud at −12°C produces the change rapidly. It is considered that by scattering small fragments of dry ice into such a cloud from an aircraft, extensive cloud systems can be thus modified. R. S. R.

551.593.64 : 535.42 *see Abstr.* 1196

551.594.221 1375

Swiss lightning investigations on Mount San Salvatore, near Lugano. BERGER, K. *Conf. Int. Gr. Rés. Élect.* [*CIGRÉ*] (*Rep. No.* 318) 18 *pp.* (1946).—In addition to the equipment described earlier [Abstr. 1141 (1944)] two cathode ray oscillographs have been installed with time sweeps of 10^{-4} and 10^{-2} sec respectively. In the course of 3 years, some 30 flashes to the lightning tower have been recorded, several of the oscillographic current records being reproduced. In addition to short-time discharges of high current amplitudes, and discharges of several thousand amperes lasting $< \frac{1}{10}$ sec, continuing currents of <1 000 A have been recorded, on which the first two types of discharges may be superimposed. A lightning photograph is reproduced showing such a superposition of high current pulses on a continuing low current discharge. The highest lightning current recorded amounts to 31 kA and this also shows the longest recorded time to ½-value of 130 μsec. The diversity of the characteristics noted in the currents recorded is emphasized. R. H. G.

551.594.221 : 621.316.98 1376

The lightning discharge and the occurrence of flashes to transmission lines. BRUCE, C. E. R., AND GOLDE, R. H. *Conf. Int. Gr. Rés. Élect.* [*CIGRÉ*] (*Rep. No.* 336) 22 *pp.* (1946).—A summarizing survey is presented of the characteristics and of the mechanism of the lightning discharge [see Abstr. 958 (1942), 1148 (1945)], and the conceptions developed are applied to an estimate of the attractive range of a lightning conductor, the number of direct flashes to a transmission line [Abstr. 2060 B (1946)] and the number of flashes to earth [Abstr. 1082 (1947)]. R. H. G.

BIOLOGY 57/59

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.843.612 = 4 1377

Intensity discrimination for a point source. IVANOFF, A. *Rev. Opt. (Théor. Instrum.)* **25,** 3–35 (*Jan.–March*); 82–112 (*April–June*, 1946) *In French.*—Describes an investigation of the minimum change of intensity perceptible in a point source of light, as determined by the least difference required to give a sensation of flicker at various speeds of alternation. Determinations were made for different intensities viewed at different regions of the retina and for pre-adaptation to different levels of brightness. An attempt is made to interpret the results obtained on the photo-chemical theory of vision. J. W. T. W.

615.844 : 621.396.611.21 : 621.365.9 1378

Crystal-controlled diathermy. NORTON, R. L. *Electronics*, **19,** 113–15 (*Oct.*, 1946).—[Abstr. 984 B (1947)].

615.849 13

Ionization measurements with bone chambers and the application to radiation therapy. STENSTROM, K. W., AN MARVIN, J. F. *Amer. J. Roentgenol. Radium Ther.*, 5 759–70 (*Dec.*, 1946).—The usual depth dose tables an isodose charts are for soft tissues only. Intervening bo tissue greatly reduces the depth dose in practice and t secondary radiation component is greatly modified. F measurements, bone cylinders of various thicknesses we fitted over the ionization chamber, and the data obtain are given in detail. Up to depths of 5 cm, max. ionizati occurred at 140 kV (peak). Relatively low volta radiation is "hardened" by its passage via bone an 220–400 kV radiation "softened." B. J.

616–073.75 : 778.33 *see Abstr.* 1382

669.71 : 621.179.152 : 539.42 *see Abstr.* 1328

678 : 539.4.015 *see Abstr.* 1323

PHOTOGRAPHY 77

778.3 1380

Low-light photography. COOK, G. H. *Photogr. J.*, **86 B,** 165–6 (*Nov.–Dec.*, 1946).—An outline of a method in which very weak negatives, resulting from underexposure through a grating in contact with the emulsion, may by diffraction give positive images of higher contrast on projection. The contrast may be varied. Partial reversal is possible. S. T. H.

778.3 : 621.385.832 : 535.371.07 *see Abstr.* 1186

778.33 1381

Measurement and calculation of unsharpness combinations in X-ray photography. KLASENS, H. A. *Philips Res. Rep.*, **1,** 241–9 (*Aug.*, 1946).

778.33 : 616–073.75 138

An analysis of the physical factors controlling th diagnostic quality of Roentgen images. IV. Contrast an the film contrast factor. MORGAN, R. H. *Amer. Roentgenol. Radium Ther.*, **55,** 627–33 (*May*, 1946).– Continues previous papers [Abstr. 1755 (1946)]. Curve are given relating film density in terms of log (exposure for films exposed non-screened, screened and photo fluorographically. These are discussed in detail wit respect to optimum conditions of development and fil density to give best contrast. B. J.

778.35 : 526.918.52 : 551.468 *see Abstr.* 1370